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AVIATION

The Oldest American Aeronautical Magazine

JULY, 1933

Getting Ready for Recovery

BUSINESS INDEXES are turning up . . . running well ahead of last year now, and rapidly approaching the 1931 level . . . automobile production is definitely on the up-grade . . . airplane production ought to follow suit . . . In the meantime . . . the public is turning to air transport in steadily increasing numbers . . . and traffic records are being broken . . . America can't get along without a nation-wide air transport system, and America knows it . . . the tide is running with us now, and we have only to keep headed in the right direction, and to avoid wasting our energies away from the main issue of supplying the best possible product and the best possible service at a fair price . .

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AVIATION

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The Oldest American Aeronautical Magazine

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Announcing the New
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SHRIKE
U. S. ARMY AIR CORPS A-12
Developed From The Curtiss YA-8

President Roosevelt **presents Collier Trophy to Glenn L. Martin; awarded by The National Aeronautical Association in recognition of** ***"Greatest Achievement in Aviation in America"*** **during the past year.**

THE AWARD

Aerial Milestone

To the White House, on Wednesday, May 31st, went Glenn L. Martin, world famous designer and builder of aircraft Awaiting him was the highest reward this nation can bestow on one who makes a really significant contribution to the science of aviation, the coveted Collier Trophy, awarded by The National Aeronautical Association. Smiling as he shook Mr. Martin by the hand was another man of accomplishment, Franklin Delano Roosevelt, who presented the trophy on behalf of the Association "for the greatest achievement in Aviation in America, the value of which has been thoroughly demonstrated by the actual use during the preceding year"

THE MAN

Pioneer Birdman

The average person remembers Glenn Martin as the developer of the Martin Bomber of wartime fame But flying men know him and his associates as resourceful and inventive designers and as practical builders of aircraft with a long list of achievements dating back to 1908. Martin Milestones: First Martin Airplane, 1908; first American Training Plane, 1912; First Bomb-dropping experiments by U S Government using Martin Planes, 1913; First American Twin-Engine Bomber, 1918; First Experimental Night Mail Plane, 1922; First American Metal Monoplane, 1922, First All Metal Seaplane, 1923; First Alloy Steel Fuselage, 1926; First Successful Large Plane for Aircraft Carriers, 1928; World's Fastest Bomber Built for U S. Army, 1932.

GLENN L. MARTIN AND THE COLLIER TROPHY
To him honor, for the greatest achievement in aviation in America

THE PLANE

World's Most Formidable

Declared the most formidable weapon yet developed for aerial defense, the new Martin Army Bomber sweeps aside all previous standards for big plane performance Flying men who witnessed its spectacular acceptance trials marvelled at its terrific speed and graceful ease with which it carried tremendous loads Designers found the reasons in important new developments in aerodynamics, in structures, in control, in propulsive efficiency. Engineers lauded the ease of inspection, servicing and maintenance made possible by standard construction wherein duplicate parts are "as alike as two pins" instead of being specially made by hand.

THE NEW MARTIN ARMY BOMBER
Propulsive efficiency previously reserved for Schneider Cup Racers

THE PLANT

Vision Fulfilled

Says Mr Martin on this subject: "Flying costs are still too high The needed economies must come, as they did in the automobile industry, not only from improvements in design, but from improvements in methods of manufacture Except for experimental development, the old-fashioned hand methods must be replaced by straight-line, machine production methods. We foresaw this fact years ago and developed our plant accordingly Today Martin parts are interchangeable just as automobile parts are interchangeable, with the same convenience and economy to their operators"

THE MARTIN PLANT AT BALTIMORE
Machine production methods make parts as alike as two pins

THE POSSIBILITIES

Swords into Plowshares

Operators of commercial air transport lines see the new Martin Plane not as an eagle of war but as a giant dove of peace They are thinking not of bomb loads but of pay loads—cargoes of passengers, mail and freight They realize that the features of the new Martin Army Bomber, when applied to commercial planes, will bring about a tremendous increase in pay load per mile per hour Since this vital factor today determines the rate of expansion of commercial aviation in America, Glenn Martin plans to produce such planes and is now prepared to discuss their possibilities with air transportation executives

AVIATION
FOR JULY 1933

Radial engines, their power and frontal area

A simple and accurate method of estimating overall diameter

By E. S. Taylor

Professor of Aeronautical Engineering
Massachusetts Institute of Technology

THE OUTSIDE diameter of a radial engine is of the utmost importance, since it determines the size of cowl ring necessary and therefore to a large extent the drag of the fuselage In most airplanes the vision forward would be markedly improved by a reduction in engine diameter The weight of an engine is also to a large extent dependent upon its outside dimensions As will be shown, the overall diameter of a properly designed radial engine may be closely estimated in terms of its general characteristics, without going to the trouble of making a number of layouts

What fixes diameter?

To accomplish that, it is necessary to treat two cases independently the first limited by the interference of adjacent pistons at the bottom of their strokes and the second by the minimum permissible ratio of connecting rod length to stroke

Under certain conditions, especially with the smaller numbers of cylinders acting on one crank-pin and the larger stroke to bore ratios, the diameter of a radial engine may be limited by the interference of the link rods in the cylinders opposite the master rod. This condition should not be allowed to limit the engine diameter It may be eliminated by decreasing the stroke-bore ratio or slotting the cylinder barrel. Only rarely, however, does this problem arise, and it has not been taken into account in the calculations which follow It is of little practical effect.

We then assume, for the two cases that are to be separately treated

1 The piston head is flat

2. The maximum height of the cylinder head, measured from the end of the cylinder barrel, is $1\frac{1}{4}$ times the bore (which corresponds to present good practice and allows the use of the largest possible valves)

3 Compression ratio of 5 (small variations here make little difference)

For the first case we also assume

4 Piston skirts of adjacent cylinders would just touch if two pistons were in their bottom center positions at the same time (This obviously provides a small amount of clearance)

5 Total length of piston is 65 per cent of the bore.

6. Length of connecting-rod in a radial engine equals 2.0 times the stroke

7 Height of piston above the center of the piston pin is 29 per cent of the bore.

Based on these assumptions, the diameter of a radial engine may be expressed

by two comparatively simple formulas corresponding to the two cases just mentioned. Simplifying still further, sample calculations can be made for a large number of cases, and the results plotted, and the diameter can then be stated as

$$D = K \sqrt[3]{V}$$

where V is the total piston displacement of all the cylinders acting on one crank-pin, and K is a constant dependent only on the number of cylinders working on one crank-pin (half the total number in a two-row engine). Values of K are plotted in Fig 1 Where the curves show a sudden break (as they do for all numbers of cylinders less than nine) the portion to the left of the break corresponds to the first case the portion to the right to the second

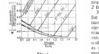


Fig 1

Considering the curve for the five-cylinder radial, it will be noted that the length of the connecting rod is the limitation for all stroke-bore ratios greater than .71, while below this value the diameter of the engine is limited by the interference of adjacent piston skirts The curve rises with great steepness when the connecting rod length determines the diameter, and the stroke-bore ratio should therefore be chosen, when practicable, in the range where piston interference will determine the diameter For five-cylinder and seven-cylinder engines, however, it is difficult to make the connecting rod and the stroke short enough to attain this condition Connecting-rod length actually presents the limiting condition in most of the seven-cylinder and fourteen-cylinder engines now in service

When the engine diameter is limited by piston interference it is the total length of the piston which determines the diameter, while when connecting rod length is the limitation, the height above the center of the piston pin is the determining factor Two quite different piston designs are likely to result, one having the pin located somewhere near the center of the bearing surface of the piston in order to shorten the connecting rod and thereby reduce its weight, while the other has the piston-pin as near as possible to the rings (See Fig 2 for examples)

Note also that the stroke-bore ratio for minimum diameter increases as the number of cylinders is increased The curves are so flat, however, that on a nine cylinder engine any stroke-bore ratio between 1.0 and 1.2 can be used without increasing the engine diameter as much as 1 per cent above its minimum value.

Since the possible size of valves decreases with increasing stroke-bore ratio, it is desirable to keep the ratio small Also, a small value allows more room in the crankcase for counterweights For these reasons, some of the best nine-cylinder radial engines are built with a stroke bore ratio of unity, rather than the 1.15 which would give the minimum diameter At a unit ratio note how small is the difference in diameter of the seven, nine and eleven-cylinder engines There is about 1.3 in. between a seven and a nine of 1,000 cu in. displacement with the eleven intermediate between the two In view of this fact the advantages of the seven in simplicity and cost would seem to make it a more logical engine than the nine where the cylinder size is within reason particularly if the connecting-rod length can be made a little less than twice the stroke to move the "break" in the seven cylinder curve farther to the right (Fig 3) The eleven-cylinder radial has no advantage over the nine, except possibly in very large engines where it is desirable to keep the cylinder size to a minimum

The very great advantage of the two-row radial is not at once apparent from the curves, but a simple calculation will show it. For engines of equal stroke and bore (k = 1), a nine-cylinder engine of 1,000 cubic inches displacement is 45.7 in in diameter while a two-row fourteen-cylinder engine measures but 37.4 in. This gives a reduction in frontal area of 33 per cent It is evident that the fourteen-cylinder two-row radial engine has a tremendous advantage when high performance is essential

Similar curves serve equally well for V engines but as that type permits of the use of shorter connecting-rods than are employed in the radials the curves are shifted somewhat The curve for a twelve-cylinder 60-deg V is plotted (dotted) in Fig. 1. It is based on the assumption of a connecting-rod length of 1.6 times the stroke, and it appears that for this engine the stroke to bore ratio should be about 1.1 for minimum outside dimensions and *minimum weight*

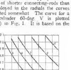


Fig 3—Maximum ratio of connecting rod to stroke still permitting piston interference to determine the outside diameter

A connecting rod length of 2.0 times the stroke though typical practice, of course is not a universal rule. Fig 3 shows the connecting-rod length at which interference of the piston skirts of adjacent cylinders ceases to determine the diameter (corresponding to the points where the curves break in Fig 1) For a nine-cylinder engine with the stroke equal to 1.1 times the bore (as in the nine-cylinder Wright Whirlwind the Pratt and Whitney engines having still lower stroke-bore ratios) the connecting-rod length could be increased to 2.07 times the stroke without effect on the over-all diameter of the engine

A comparison of actual diameters with those calculated by Fig 1 has been made for almost all present-day American radials, and for several of foreign origin In every case except five, the calculated and actual diameters agree within 3 per cent On the strength of that record Fig 1 can be used with some confidence that it will almost invariably give the overall diameter of a radial, of any size or type, correct to within 2 in and in most instances with less than half that error

Fig 2—Left, piston from a 60 deg V engine in which the connecting rod determines the overall dimensions of the engine Right piston from a nine cylinder radial engine in which interference of the piston skirts determines the outside diameter

In the light of recent military operations in Manchukuo and because so little is known of the flying equipment of the Japanese Army and Navy, this article occupies an important position in our series devoted to the world's air forces. A somewhat more extensive treatment than usual has been accorded to the historical background in an attempt to fill a gap that has existed in American knowledge of oriental aeronautics In the introductory portion as well as in the descriptive sections we present material, previously unpublished, which should be of interest to every student of aerial warfare and military airplane design.

JAPAN: THE TENTH OF A SERIES

The equipment of air forces

By AVIATION's Japanese Correspondent

JAPAN, whose eyes were opened to world civilization by an American, Commodore Perry, was also led by Americans into the field of aviation The first balloon which flew in Japanese skies was introduced by a Mr Spencer, in 1892 He was followed by Charles K Hamilton in 1909 with an airship, making a flight over Tokyo City In 1911 Japan saw the first public flights of an airplane made in various parts of Japan by Mr Mars. Naturally stimulating the national attention, that event had much to do with the future development of Japanese aviation Mr Mars was followed in 1912 by a fourth American, W B Atwater, who, introduced the first seaplane, and at the same time conducted mail flights between Tokyo and Yokohama. It was in 1916 that two Americans, Art Smith and Mr Niles, demonstrated to us acrobatic flights and created a great sensation. Since that time Japanese aviation has been developed, showing gradual improvement

Strength of the service

The Imperial Japanese Army has in 1933 eight regiments of aircraft, consisting of about 800 first-line planes The Navy, too, has about 450 first-line airplanes based on shore, and 350 shipboard airplanes The civil airways connecting all the important cities of Japan have yearly been extended, and were in 1932 connected with the Manchurian Airways

At present about 90 per cent of the airplane production is "home made" and the foreign aircraft are gradually being replaced by Japanese built machines It is noteworthy that the Japanese aircraft industry, which owed so much to Americans, is gradually supplanting the American aircraft and engines At present, the Japanese Army and Navy use almost no American material A few Fokker Universal passenger planes and Wright Whirlwind engines are employed by Japan Air Transport Company, which operates mail and passenger airlines, but those are to be replaced by Japanese-built machines

Japanese factories at first produced foreign designed airplanes, such as Nieuport, Salmson, and Gloster, to the order of the Navy and Army, but in recent years many changes have been made, and about 80 per cent of the military airplanes which are now being supplied to the Navy and Army are of Japanese design The aircraft industry is now entering the period of metal construction and the new first line machines are built largely of aluminum alloys The new Nakajima 90 fighter, Kawasaki 92 fighter, Kawasaki 88 reconnaissance or bomber, Mitsubishi light reconnaissance, and Nakajima 90 shipboard fighter and Kawanishi 90 naval scouting plane are good examples. (The type numbers of the military airplanes indicate the dates at which the various types appeared The year 2592, counting from the foundation of the Japanese Empire corresponds to 1932 of the Christian Era Therefore, the Kawasaki 92 fighter was introduced in 1932, the type 88 in 1928)

The aircraft industry has not yet advanced to the point of producing machines of all-metal construction from their own designs, but the Kawasaki Aircraft Works has produced a few types from Dornier patterns Quite recently the Mitsubishi Aircraft Works constructed a Junkers G 38 (the four-engined giant), and the Kawanishi Aircraft Works built a Short all-metal flying boat of very large dimensions The Hiro Naval Aircraft Works have gone farther than the private industry in developing new types of construction, and their splendid workmanship is well illustrated in the excellent performance of the Navy's 90 1 all metal flying boat with three 700-hp Hispano engines, produced in 1930

Extent of the industry

At present Japan has six large civil aircraft works, Mitsubishi, Kawasaki, Kawanishi, Ishikawajima, Nakajima, and Aichi, and five aero engine manufacturers, Mitsubishi, Kawasaki, Nakajima, Aichi, and Tokyo Gas Denki

They have been devoted almost entirely to the production of military planes, and have had very little export business. However, an exception was recently made in the sale of five transport planes (built under Fokker license) by the Nakajima Aircraft Works to the Manchuria Air Transport Company, a newly-established company conducting a regular airline in Manchuria.

The production of military airplanes has not been entirely in the hands of the industry, but has been carried on also by the Army in its Nagoya and Chigusa Arsenals and by the Navy in its Hiro and Yokosuka Navy Yards In the

interest of promotion of the civil aircraft industry, the government as a rule gives orders for production from official designs and sometimes requests also the tender of private designs, the best being adopted. The strictest supervision is maintained by the government, which in some cases releases no specifications on new planes. Japanese-designed high-powered engines have not yet been produced, and Hispanos, Napiers, Lorraines, Jupiters, and B M W's are built in Japan. It may be expected, however, that Japanese-designed engines will soon replace the foreign ones.

Testing and design competition

The experimental planes produced by the industry from the official designs are subjected to severe tests by the Navy in the Yokosuka Naval Aircraft Factory and by the Army in its Army Aviation Engineering division at Tokorozawa and Tachikawa. With a view to promoting the civil aircraft industry, the government plans from time to time to conduct flying contests in which civil made airplanes are requested to join, the winning types being adopted for military use. The Nakajima 91 fighter and Kawasaki 92 fighter, air-cooled and water-cooled respectively, are good examples of machines so developed.

As the readers will see, the relation between the government and the aircraft industry is very close, and civil aviation is still in its infancy as compared with the activities of the Navy and Army which have brought the industry to its present state. When foreign machines are required as models or for other purposes, they are usually purchased from the foreign countries by the Mitsubishi or Mitsui concerns, acting for the government.

Another important factor playing a big part in the promotion of Japanese aviation is the activity of the large newspapers, such as the Asahi and Mainichi in Tokyo and Osaka, each having a fleet of airplanes at their disposal. Their machines played an important part in the recent Manchurian conflicts. When a new and important type is produced in a foreign country, the newspapers often purchase an example and contribute it to Japanese aviation. As soon as Colonel Lindbergh succeeded in the trans-Atlantic flight on a Ryan monoplane, one was bought by a newspaper company here and when the Puss Moth appeared in England, a sample was promptly purchased. The autogiro was recently introduced to Japan in the same way. Many foreign manufacturers have failed in recent campaigns to sell their machines in Japan. Japan no longer buys foreign machines after the simple demonstration flights with which foreign companies once thought they could sell. Prominent American and European builders have been among the recent failures, because they knew little of present conditions and requirements of Japanese aviation.

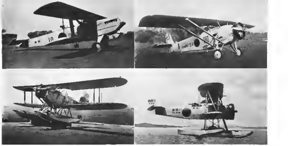
Japanese aviation has made remarkable progress in the last few years, but in spite of that the present air forces are far behind those of the other air powers of the world. But nation-wide attention has been awakened to the importance of air defence, as shown by the recent popular subscription to contribute aircraft to the government. Now it is quite likely that the nation will give the same strong support as was given to the construction of warships and submarines in past years.

The naval air service

Aircraft having been recognized as great factors in future war on the ocean as early as 1909 a naval commission of 21 headed by Capt. K. Yamaji was appointed to study their possibilities and in the following year five officers were ordered to France and the United States for the study of the art of flying. At the same time, three engineer lieutenants were sent to Europe and America to study technical matters. One of the three, C. Nakajima, is the present president of the Nakajima Aircraft Works. The officers returned in 1912, bringing from France two Farman pusher seaplanes and from U S A two Curtiss seaplanes. Immediately on their return an air station was opened near Yokosuka Naval Port, and six young pilots were trained.

At the end of 1913 the Navy ordered from France two Deperdussin monoplane seaplanes, of greater speed and powered with 100-hp and 140-hp Gnome engines. The Naval flyers had already been trained to such an extent that they could easily handle the new machines, which required more than ordinary skill on the part of pilot.

The development of fighting plane design in Japan. Upper left: The first Japanese-built fighter, Nieuport-designed, and Nakajima-constructed in 1922. Upper right: Nakajima's latest fighter still shows a strong French influence, and reports 168 m.p.h. Lower left: The Kawasaki fighter of 1932 makes 205 m.p.h. with 500 hp. Note the curious interplane strut arrangement. Lower right: Nakajima also builds a biplane fighter, again with ring cowl and with guns set low in the sides of the fuselage in British fashion, for aircraft carrier use.



Recent scouting and observation types. Upper left: The Kawasaki long-range observation biplane, now four years old, weighs over 6200 lb. loaded. Upper right: Mitsubishi's observation monoplane, a 1932 product. Lower left: The Kawanishi scout for shore-based naval service. Lower right: The Navy, observation seaplane, developed in 1930 is very faithful to the Vought Corsair's lines.

In the meantime the Naval engineers endeavored to build a seaplane themselves, and after several trials a ship of the Farman type was successfully completed with Japanese materials. As the number of student flyers increased they found it insufficient to train only on the calm seas near the air stations, and wanted to fly on the open ocean or along the coasts. To meet these requirements the Navy reconstructed the transport "Wakamiya" and made it the first seaplane carrier, on which five Farman seaplanes were loaded for open-water training. In 1914, the "Wakamiya" carried naval planes to Chingtao for bombardment and scouting over the fortress there. In 1915 an endurance flight for ten hours was made on a Farman type seaplane of purely Japanese construction, even including the engine. The flight was at the same time a test for the engine produced in the Naval Yard toward the end of 1914.

The last year of the War saw a purchase of Tellier two-seater military flying boats from France, and in the following year there was bought a Tellier twin engine military flying boat with twin 300-hp Hispano-Suizas. The study of large-sized flying boats started at that point. By 1919 about 60 per cent of the military airplanes were being produced in Japan from Japanese materials—both planes and engines.

In 1918 the Navy decided to establish a large aircraft factory at Kure to meet the requirements resulting from the enlargement of the Naval Air Service. It was said at that time that the factory would have a production capacity of more than 60 planes per month on its completion. At the same time a Naval Aeronautical Laboratory was opened in Tokyo.

Training naval pilots

With the beginning of construction of the aircraft carrier "Hosho" in 1921, it became necessary to train naval pilots on land-planes, and the Navy established a large Naval aerodrome near Lake Kasumigaura. In the same year, a group of English airmen headed by Colonel the Master of Sempill, lately of the Royal Air Force in the Great War, was invited to act as instructors to the Navy. A large number of airplanes and engines were then purchased from England. They were of a dozen different models—landplanes, seaplanes, and flying boats.

In the meantime the privately operated aircraft works—Mitsubishi, Kawasaki, Aichi, Nakajima, etc.—were established and were producing military airplanes. The Mitsubishi airplanes built immediately after the War are still used for training in the Naval Flying School. In 1922 the first aircraft carrier, the "Hosho," was completed, and the airplane for the first time joined the Fleet.

The study of large-sized all-metal flying boats was initiated about 1923, and boats such as the Rohrbach and Dornier were put on test. The final result was the production of the all-metal monoplane flying boat Navy 90-1 (three 700-hp Hispanos) in Hiro Navy Yard in 1930. The Japanese boat was said to have higher performance than the Short flying boat (three 800-hp Rolls Royces) which was purchased from England in the same year. Kawanishi Aircraft Works purchased construction rights on the Short. The first Japanese-built example appeared early this year (1933) and the second will be completed in April. The Hiro 90-1 type has been adopted as a standard Navy machine, and many are being produced at present.

The Navy 14 type, powered with a 400-hp Lorraine, was adopted in 1925 as a scouting seaplane, and in the following year was remodelled and fitted with a Lorraine of 450 hp. resulting in an increase in performance. This 3-seater biplane is carried on many Japanese battleships and cruisers.

The Navy's standard two-seater observation plane is the type 15 with 300 hp Hispano. The British F 5 flying boat has been remodeled with twin 450 hp Lorraines, and many structural improvements. Several non-stop flights

Bombers and boats. Upper left: The Mitsubishi torpedo plane of 1921 appeared when Japanese navy aviation was under a strong British influence. Above: Modern Mitsubishi type, for bombing from aircraft carriers. Left: Kawasaki's bomber of 1927 shows the effect of Kawasaki's Dornier license. Below: The Hiro navy yard's flying boat shows Short and Rohrbach features, together with points of marked originality; weighs 28,400 lb., totals 2,200 hp., is the largest airplane so far attempted by Japan

between Yokosuka and Marshall Island (about 2,500 miles) have been made with this boat. In 1928 the Gloster Gambet (Jupiter 450 hp.) won the contest for shipboard fighters, and the license to manufacture was bought from England. It was with machines of this type that our naval fliers shot down the Chinese fighter in the recent Shanghai troubles, the first air combat in the Orient.

In 1929 the Navy type 89 bombing biplane was completed. The specification has not yet been released, but it is probably a powerful bomber fitted with Hispano or Rolls-Royce 650 hp. engine, carrying an 18-in. torpedo and having a range of 750 miles. In 1930, in addition to the above, the Nakajima type 90 fighter, Kawanishi type 90 scouting seaplane, and Navy-designed type 90-II scouting seaplane (all with 450-hp. Jupiters) were standardized by the Navy. The Hawker Nimrod shipboard single-seater fighter is being tested in the Naval Air Service. The construction license has been purchased from England, and the machine will be built in Japan in the near future. Also several types of shipboard dive-bomber, two-seater shipboard fighter, and large flying boats for coastal patrol are being tested by the naval authorities. The airplanes now in active use are given in Table 1.

The army

The Japanese Army's aeronautical history is even longer than that of the Navy. The return of Lieutenant Tokugawa (now a Baron and a Major-General and president of the Army Flying School) from France in 1910 with a Henry Farman Biplane (50 hp. Gnome) marked the introduction of the first army airplane. He had trained in France, and was really the first licensed flyer in Japan. In the same year Major Hino also returned from Germany with a 25 hp. Grade monoplane, and made flights from the Yoyogi Parade Ground in Tokyo on Dec. 19, 1910. Those two machines were the first military airplanes that the Japanese Army possessed. The following year saw the purchase of a Wright biplane and a Bleriot monoplane, and flights as long as one hour were made. The first Army Flying School was established in 1912. In the same year, Captain Tokugawa succeeded in building by himself a Gnome-engined biplane, on which he made a flight from Tokorozawa Aerodrome to Tokyo. So appeared the first Japanese-built military airplane.

In 1913 two Maurice Farman biplanes (70-hp. Renault) and one Nieuport monoplane (50 hp. Gnome) were brought to Japan from France, and shortly thereafter Maurice Farman biplanes were adopted as a standard machine in the Army Flying Corps and built with Japanese materials in the Army arsenals. The Maurice Farman type continued in use in the Army Flying Corps until the first Nakajima biplane with a 150 hp. Hall-Scott was adopted in 1919.

The Japanese Army flyers lacked experience of actual combat during the Great War, having only sent one squadron to the bombardment of Chingao and a few fliers to the Western front. To supply this want, after the armistice a group of veteran airmen of the French Air Forces were invited as instructors to the Army Flying Corps. The French mission was headed by Colonel Faure. The memorable service which the mission rendered to the Japanese Army Flying Corps should be forever remembered.

Many French and British types were tried during the years immediately after the war. In 1922 the Spad-Herbermont and Nieuport 29 C.1 (both with 300-hp. Hispano) were purchased from France and tested as the first Army fighters. The Nieuport was adopted as a standard and has since been produced by the Nakajima Aircraft Works in large numbers. [See J. J. Ide's article on French equipment in AVIATION for April for more detailed information on the Nieuport 29.]

The Army Flying Corps in 1925 standardized the airplanes hitherto produced, as follows:

	Nieuport (Nakajima) Hispano 300 hp. Fighter	Salmson (Kawasaki and Army arsenal) Salmson 230 hp. Reconnaissance
Weight empty (lb.)	1 870	2 000
Total weight (lb.)	2 552	3 300
Maximum speed (m.p.h.)	138*	112*
Cruising speed (m.p.h.)	100	95
Landing speed (m.p.h.)	52	44
Climb to 5 500 ft.	3 min. 20 sec	4 min. 16 sec
Climb to 9 800 ft.	10 min. 50 sec	13 min 10 sec
Service ceiling (ft.)	22,100*	18,400*
Duration (hours)	2*	3*

*The Farman, powered with two 230 Salmson engines, had a maximum speed of 100 m.p.h., service ceiling of 14 800 ft., and duration of from 4 to 6 hours.

The Aviation Engineering division of Japanese Army also has been making a careful study of production as well as testing of airplanes, especially large all-metal bombing types. In 1927 the Kawasaki-Dornier Don, with two 450-hp. B.M.W. engines, a successful production of Kawasaki Aircraft Works, was adopted for service. This was followed by adoption of the Mitsubishi Biplane (Hispano 450 hp.) as light bomber produced by Mitsubishi Aircraft Works. The former is still in use in the Army Flying Corps, and the performance is as follows:

	Mitsubishi Light bomber Hispano 450-hp.	Kawasaki Dornier Heavy bomber Two 450-hp. Kawasaki B.M.W.
Weight empty (lb.)	4 080	9 680
Gross weight (lb.)	7 320	16 823
Maximum speed (m.p.h.)	112	106
Landing speed (m.p.h.)	69	66
Climb to 5 500 ft.	9 min. 50 sec.	10 min. 55 sec.
Climb to 9 800 ft.	56 min. 45 sec.	44 min. 10 sec.
Service ceiling (ft.)	13,100	11 400
Duration (hours)	3	5

In 1928 the Ishikawajima T. 3 biplane (Kawasaki B.M.W. 450 hp.), Nakajima N 35 (Nakajima-Lorraine 650 hp.), Mitsubishi Washi biplane (Mitsubishi-Hispano 450 hp.), and Kawasaki 88 biplane (Kawasaki-B.M.W. 450 hp.), all reconnaissance-bombers, took part in the flying contest held by the Army Flying Corps. The Kawasaki plane passed most creditably and was adopted and designated as type 88 reconnaissance bomber. The Kawasaki (450-hp. Kawasaki B.M.W. engine) is a biplane of all metal construction and the performance is as follows:

Weight empty (lb.)	3 872
Gross weight (lb.)	6 270
Maximum speed (m.p.h.)	124
Minimum speed (m.p.h.)	59
Climb to 3,300 ft.	4 min. 50 sec.
Climb to 5 600 ft.	15 min. 45 sec.
Climb to 16 400 ft.	35 min. 15 sec.
Service ceiling (ft.)	21 300
Duration (hours)	4–5

This machine however was later reconstructed and designated type 88-II. Improvements were made in tail and fuselage nose and higher performances secured.

In 1930 a contest for Japanese-designed fighters was held and the Nakajima monoplane (Jupiter 450 hp.) was adopted for service as type 90 fighter and in 1932 the Kawasaki biplane (500 hp. Kawasaki B.M.W.) as type 92 fighter. Also in 1932 the Army adopted the Mitsubishi light reconnaissance monoplane (420-hp. Mitsubishi Jaguar, as standard type.

The Japanese Army Flying Corps is now fully equipped with Japanese-made machines and we can safely say that it is equally as powerful as those of the other air powers of the world. The recent Manchuria troubles provided an opportunity to the Army Flying Corps to demonstrate its power. The Army has now about 100 powerful fighters and reconnaissance-bomber planes named "Aikoku-go," which means patriotism, contributed by the Japanese people as a result of nation-wide interest in air defense.

During 1933 a new two-seater fighter and Army co-operation plane will be adopted and it is understood that the civil aircraft works are now at work on its construction to Army specifications. A large military all-metal super heavy bomber resembling the Junkers G 38 is now being built by Mitsubishi Aircraft Works as a war ship of the air. The Army also has a plan to produce a more powerful fighter to strengthen the first line of the national air defense, but the particulars are not yet known.

The list of first-line use airplanes (Table 2) will give an outline of equipment of the Japanese Army Flying Corps as it exists today.

Table 1

	Type	Number in Crews	Engine and Horsepower	Span	Length	Height	Total Weight (lb.)	Speed (m.p.h.)
A. Fighter								
Navy 3 (Gloster Gambet)	B	1	Jupiter 450	31' 10"	22' 4"		3 050	156
Nakajima 90	B	1	Jupiter 450	30' 10"	21' 7"	7' 5"	2,860	193
B. Reconnaissance								
Navy 14-II	B	3	Lorraine 450	46' 7"	35' 9"	13' 5"	6,050	111
Navy 15	B	2	Hispano 300	44' 7"	31' 6"	12' 2"	4 200	114
Kawanishi 90	B	3	Jupiter 450	47' 10"	34' 10"	10' 2'	5 500	—
Navy 90-II	B	2	Jupiter, 450	39' 5"	29' 6"	—	—	—
C. Bomber								
Navy 13	B	3	Napier 450	45' 3"	32' 10"	11' 6"	6 270	125
Navy 89	B	3	Hispano 600	—	—	—	—	—
D. Patrol or Bomber Flying Boat								
Navy 15	B	4	3 Lorraine 450 (900 hp.)	103' 7"	49' 6"	18' 0"	12 815	89
Navy 90-1	M	6	3 Hispano 700 (2 100 hp)	98' 5"	68' 11"		26,400	132
Short 90-II	B	6	3 Rolls Royce 800 (2 400 hp.)	98' 5"	65' 7"	—	28 600	137

Table 2

Name	Type	Seat	Engine and Horsepower	Span	Length	Height	Total Weight (lb.)	Speed (m.p.h.)	Climb (ft.)
A. Fighter									
Army 91 type (Nakajima)	M	1	Jupiter 450	34' 2"	23' 10"	10' 2"	3 300	200	16 400 (10 min.)
Army 92 type (Kawasaki)	B	1	Kawasaki B.M.W. 500	31' 2"	23' 8"	10' 6"	3 740	205	19 400 (9 min.)
B. Reconnaissance									
Army 88-II type (Kawasaki)	B	2	Kawasaki B.M.W. 450	49' 10"	37' 0"	11' 1"	6 270	143	9 840 (15½ min.)
Army 92 type (Mitsubishi)	M	2	Mitsubishi Jaguar 420	41' 8"	27' 11"	9' 9"	5 500	137	9 840 (12 min.)
C. Bomber									
Army 88-II type (Kawasaki)	B	2	Kawasaki B.M.W. 450	50' 11"	37' 9"	11' 1"	8 020	150	9 840 (25 min.)
Army 87 type (Kawasaki-Dornier)	M	5	2 Kawasaki B.M.W. 450 (900 hp.)	93' 6"	62' 5"	20' 2"	14 940	106	9 840 (44½ min.)

Although there is no novelty in trans-Atlantic flight, the knowledge gleaned from many crossings has failed to find application. A number of preliminary surveys of the routes have been made by operators here and abroad, but regular scheduled flight is still to be accomplished. In the accompanying article, a successful trans-Atlantic flyer tells why it has not been done and suggests the ways and means by which it could be done.

Trans-Atlantic air lanes

A consideration of three commonly accepted routes

By Roger Q. Williams

A MAN in New York received a cable that his wife was dying in Paris He went to three trans-Atlantic pilots and, offering to buy all the necessary equipment and pay the flyer who took him, asked to be flown across He never got there. In fact, he never left New York

The first pilot could not produce the flying equipment necessary for reasonable safety on such a trip in the middle of the winter The second pilot said the weather was an invitation to suicide The third pilot was sure they could get across on the southern route by way of South America, but as the distance to be flown was 10 000 miles, a minimum flying time of four days, the time element forced them to abandon the attempt

Before all of these decisions had been reached, the man's wife was dead

The husband, having indirectly backed one ocean flight several years previous, wanted with justice to know why a man could not hire trained personnel and buy adequate equipment to take him to Europe in a hurry He wanted to know when it would be possible to fly across the Atlantic and return with a saving over boat time. He wanted to know what was the sense of experimental ocean flights when the one big result was that a man could not today buy air passage to Europe

There are thousands of air travelers like him, people who want and who have a right to know what is holding up reliable, routine trans-Atlantic air schedules, and when ocean airline travel will become a reality.

Before these questions can be answered the real problems must be honestly faced Every one of us will be invited and urged to make Atlantic crossings by air within the next few years. But we must know, before we venture on such trips as paying passengers, what our chances are

Five problems

There are, fundamentally, five problems to be overcome before routine airlines will ever be able to make these scheduled flights Adequate flying equipment must be provided The winter weather hazards of the Great Circle route must be circumvented Piloting personnel of long experience in ocean flying will have to be highly trained Flying speeds must be stepped up to offer greater advantage over the fast, comfortable steamship schedules of today and tomorrow And something must be done about carrying more baggage than is now permitted on operating airlines

The answer to excess baggage has already been satisfactorily supplied by airships But the practicality of lighter-than-air craft as a commercial vehicle of ocean traveling has not been proven The Los Angeles, the Graf Zeppelin, and the Macon carry enough weight to make their operation profitable, but this qualification, plus their comfort, is not enough to make them commercially practical, for they are too slow and too much at the mercy of storms

The Graf Zeppelin, commanded by Dr Hugo Eckener, made the first commercial trans-Atlantic flight from Friedrichshafen to Lakehurst, carrying twenty passengers. The trip to America required 105 hours The return crossing had a gale to help the ship along, and was made at a speed of 70 m p h The average speed both ways was 58¼ m.p h Starting July 31st 1929, the Graf made its third Atlantic flight at an average speed of 54 m p h

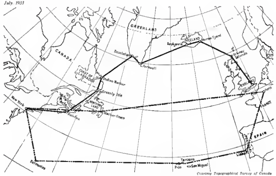
The question airship backers must answer is this Who will pay the large excess fares for such flights when the same results can be achieved by steamship and by rail at a loss of approximately only 2 per cent in traveling time? Commercially, also, airships can only be handled during take off and landing under highly favorable wind conditions. So the craft, despite its great lifting power and roomy comfort, defeats its own purpose by being too cumbersome and slow

The airplane's chances

Heavier-than-air craft, airplanes in general, are nearer the mark, although today the chances in flying the Atlantic by plane are against coming through alive Out of 48 attempts to fly the Atlantic, 22 have been, eventually, successful Seven airplane crews have been picked up by steamship and saved from drowning The others have never been heard from

Yet an airplane engine will now do its job without fail in all weather, under all commercial flying conditions, and airplanes controlled by competent and experienced pilots are safe and dependable under normal commercial loads The trouble is that a normal load today includes only enough gas and oil for 500 miles of flight on an airline, carrying ten passengers, a crew of four, and four hundred pounds of baggage You cannot cross the Atlantic Ocean in such a plane

This condition of being unable to carry sufficient baggage and of being unable to overcome fog difficulties could never be tolerated commercially on regular ocean flights. Baggage might be taken in a separate express plane, but in fog and storms an airplane cannot sit down



Courtesy Topographical Survey of Canada

Three trans-Atlantic air routes drawn on a projection that gives almost exactly (within 4 per cent) a true scale over the whole area of the map

on the Atlantic Ocean without being pounded to pieces in very short order The ship has to go through to its destination

Over the Great Circle

Capt J Erroll Boyd, who flew the Columbia to England on the last trip it made, is the only man who has ever flown the Great Circle course in winter He left America on Oct 19 and that is winter in Newfoundland and all northern points on the route His report is that the flight is absolutely impossible during the winter months from the commercial passenger point of view

Since it is commercially impossible to invite passengers to fly over this Great Circle route the year round there should be another course By virtue of a number of things, the chief one being the fact that so many deaths had occurred on the northern route I happened to be the man who flew the direct or southern, route to Europe on the Rome flight But the course I have in mind is not, in fact, the Rome flight route It is a consequence of that venture, and may point out at least one of the advantages of trans Atlantic flying on an experimental basis

As a result of Rome flight errors in navigation, and in turn as a result of the subsequent round-trip non-stop Bermuda flight of Captain Boyd, Harry Connor and myself, certain facts and conclusions have been evolved into a reasonable ocean course for airplanes Charts, weather maps, sail and steamship logs, sea captains and navigators, notably among the latter Capt Piero Bonelli Italian naval aviator and navigator on the Italian Line, have been consulted in checking the route from all angles

New York to Portugal

That route is from New York to Portugal The first leg is from New York to Bermuda, approximately 800 miles At a cruising speed of 100 m p h a low average, this hop amounts to eight hours flying time The second leg is from Bermuda to the Azores, an over-water distance of 2,000 miles, or twenty hours flight. The third leg is from the Azores to Lisbon, Portugal, about 1,200 miles over water flown in twelve hours

The total mileage on this route is around 4,000, or 40 hours flying time at 100 m p h With the smaller, faster planes that should be used, the time would be proportionately less The Great Circle route from New York to London is 3,400 miles, and practicable for only half the year at best There is 600 miles difference in favor of the Great Circle course

From Lisbon to London, Paris Berlin or Rome, is an additional airplane trip of about ten hours or a bit longer In favor of the direct southern route however, is the fact that it is an all-year course with almost ideal flying conditions The average temperature is around seventy degrees neither too warm nor too cool for passengers or motor The longest water jump, the 2,000 miles between the Azores and Bermuda, is approximately the same as the distance over water between Newfoundland and Ireland but without the fog conditions always to be found on the northern passage even in the best part of the year

Also the New York-Portugal flight is a two way trip Airplanes can go from America to Europe and return without waiting for months for favorable wind conditions on the westward flight Coste and Bellonte have to their credit the only westward crossing of the Atlantic along the Great Circle route that actually was completed non-stop And that flight took two years in preparation, and four months additional wait for ideal winds According to Dr Kimball, great authority on trans-oceanic weather, the Coste-Bellonte flight conditions, in respect to weather, could not be duplicated for years Where is the air passenger who can afford to wait 28 months or longer to get home again?

There is a trick to the weather on the Portugal-New York course, and that is the reason for including the Bermuda leg A scrutiny of a weather map of the route will disclose that a little north of the straight Bermuda-Azores course the prevailing winds are light westerly and northwesterly, and a little south of the same direct course the prevailing

winds are light northeasterly, calm, or very light westerly.

On the western passage, from the Azores to Bermuda, by angling a bit south of the straight course advantage can be taken of favoring winds, and by angling a bit north on the eastern course the same advantage in tail-winds can be had. Tail-winds add to safety by increasing the speed of flight, by conserving fuel, and by shortening the flying time.

Head-winds, on the contrary, have defeated many an attempted flight over the Great Circle route. And a study of weather charts of the Bermuda-Azores course over a period of years indicate only two or three troublesome storms during the months of January, February and March, the worst flying months on the northern route.

Into the Arctic

Serious-minded air transport companies, trying to overcome the long distance water hazards of the North Atlantic, have been charting a route which if anything is worse than the Great Circle course; and working from the other side, Imperial Airways of Great Britain and Wolfgang von Gronau, backed by a German airline, have been exploring the same route.

That route is from New York to Halifax, then to Greenley Isle in northern Newfoundland, then to Indian Harbor on the Coast of Labrador, on again to Desolation and Cape Farewell in Greenland, on once more to Reykjavik and Horna Fiord in Iceland, then to Kirkwall in North Scotland, and finally to London, England. The longest water jump on the route is 600 miles between Greenland and Iceland, and that is about everything that can be said in its favor.

The total distance of this arctic flight is about 5 200 miles which non-stop might be made in 52 hours with our 100-mile plane, although the fastest trip on the route thus far is over ten days. The course has actually ten refueling stops, which consume time and increase the risk because of the prevailing fog, storms, cold, snow, and bad landing facilities on water and land resulting from freezing conditions throughout most of the year. In this latitude there is darkness for 22 hours daily six months of the year.

In the case of a forced landing, Eskimos must be depended upon for shelter and help. The greater part of the region flown over on the route is barren waste land and ice floating upon the sea. The price of avoiding long water trips on this course is not worth the effort, expense, and discomfort.

Africa to South America

In the extreme south down below the equator, the European airlines have been developing a route from European centers that runs as follows: across Europe to Spain, down the coast of Africa to St Louis or Bathurst in French West Africa and British Gambia, then across the South Atlantic to Natal in Pernambuco, the coast of South America. The longest distance across water on this route is 1,600 miles, and the winds are so slight as to assume no great problem in flight either eastward or westward. But continuing on up the South American coast from Natal to the Caribbean Sea and across to Cuba, thence to Florida and on up the coast of North America to New York, is a total flying distance of about 10,000 miles from Paris, France. Obviously the route is totally impractical from the standpoint of American air commerce.

There are, then, four charted routes across the ocean to Europe by air. Of the three in the northern hemisphere only one the New York-Portugal course is an all-year practical proposition. The fourth route, the only one in which commercial operation has been attempted, is the long South American trip. It cannot compete with a modern steamship passage in comfort, cost, time, or reliability.

Ship-and-plane combinations

A recent record of the North German Lloyd steamship Bremen is 111 hours and 56 minutes from Europe to New York. The Bremen will carry your trunks, your family, your automobile and all your relatives in a floating palace and will beat the best flying time on the South-Atlantic route from New York to Paris. At each end of the Bremen's run, 24 hours from shore, a Heinkel seaplane is catapulted from the steamship and scoots in ahead with the mail, arriving almost a day ahead of the ship. Presently this mail service will be further speeded up by having the steamer pick up a mailplane that leaves shore 24 hours after the departure of the Bremen.

Ocean going aviation must overcome this form of passenger and mail competition. Ill-advised, under-financed ocean flights such as many of the failures of the past, attempted by men who lacked proper training and experience, are useless. The pioneering has been done, so far as it can be done by the individual pilot. The time is now at hand when the laboratory work in the shop and over the ocean must be taken up by American business interests with sufficient financial backing to employ the men who have the experience and the initiative to establish a successful, profitable air route across the Atlantic with minimum danger to life and equipment. Group attack on the trans-Atlantic problem by the organized efforts of the banker, the business man, and the ocean pilot is the only intelligent solution.

What is being done today in America to utilize the information which has been so expensively obtained to establish a practical and safe trans-Atlantic air service?

Large seaplanes are in service such as the Sikorsky Clipper and Consolidated Commodores of Pan American and the Dornier DoX. These planes carry upward of 30 passengers and light baggage. They typically cruise around 110 m.p.h. and their maximum flying distance is around a thousand miles with normal loads.

Sea-going airdromes

There have been attempts to perfect sea-going airdromes, but I have yet to find a sea captain who believes the idea is practical in heavy weather, although these dromes would have to be built at a cost of over a million dollars and some of the inventors claim various means for calming turbulent water for a safe landing.

The seadrome is, from an aeronautical point of view, an evasion of the real problems of trans-oceanic flying. In high seas no landing could be made upon such dromes. And if the several millions of dollars that are likely to be spent on seadromes were, instead, put into the aviation industry and used intelligently there would be ships and hulls that could fly an ocean dependably with passengers, mail, and baggage.

Today, using only the equipment on hand, the New York-Bermuda-Azores-Portugal route could be flown as an air-mail run. It simply requires fast planes with floats and controllable-pitch propellers and of course the necessary radio equipment. All of this we have at the present time.

The immediate problem

Approaching ocean flying as a real and immediately soluble problem, and examining the facts at hand, the method successfully employed by the builders of the domestic airlines is ready and reasonable. They started with short and comparatively easy runs and developed as the individual problems confronting them were overcome.

When planes, radio-beacons and radio communication now in daily use have been successfully adapted to the Bermuda flight we shall be ready to carry on on the remaining legs of the line in the same manner of safe experiment and test. Right now enough actual traffic exists, both passenger and mail, between New York and Bermuda, to warrant such a venture.

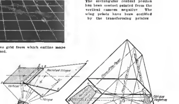
And then, with fast planes,—New York to Bermuda by air in six hours without sea-sickness. Bermuda to the Azores in twelve hours, the Azores to Portugal in eight hours. This can be done. The preparatory steps can be taken right now, and without delay or great expense.

Multiple lens aerial camera lends speed and accuracy to the map maker

The all-seeing eye

Oblique picture with superimposed perspective grid from which outline maps may be prepared.

Assembly of prints from a single exposure with the five lens camera. The rectangular central portion has been contact printed from the vertical camera negative. The wing prints have been rectified by the transforming printer



Left: Relationship between vertical and oblique portions of a multi-lens picture before and after rectification of the oblique. *ABCD* represent the vertical negative and print. *EFGH* is the original oblique negative and *efgh* the final picture after rectification in the transforming printer. Right: Schematic arrangement of transforming printer to rectify oblique negatives to vertical prints.

THE SCIENCE of cartography was born when some nameless primitive man scratched a crude diagram on the sandy floor of his cave to show his family where lay the carcass of the day's kill—but it is a far cry from meaningless marks in the dust to the exact and detailed maps available to-day. For centuries, however, progress has been painfully slow. Man has crawled or sailed over most of the globe recording the lay of the land, more often than not with astounding inaccuracies. For the most part his equipment has been meager and faulty. It was not until the War of 1914-1918 developed the airplane and methods of aerial photography that truly revolutionary changes took place. To-day it is possible to collect in a few hours data that would have required years of hard if not impossible labor by ground survey methods.

The application of photography to topographical surveying was early recognized. Dr E Deville, one-time Surveyor-General of Canada, in his treatise on photographic surveying (1889) states "Arago, in presenting Daguerre's discovery (in 1839) pointed out its application to surveying, but it was not until 25 years later that Laussedat gave a full exposition of the method. His work was so complete that little has been added to it since." Before the advent of the airplane, however, photographic survey was limited to the taking of panoramic pictures from two or more fixed elevations. Putting the camera into the air, although introducing a number of new problems, overcame at one stroke the restrictions on the earlier method. It made possible, for example, the recent photographing for mapping purposes of the entire state of Massachusetts in slightly over 24 flying hours, a job which would have taken well organized ground parties at least two years to accomplish with only reasonable accuracy.

There are two possible ways of taking aerial photographs for map making, i. e. vertically, where the optical axis of the camera is normal to the surface being photographed, and obliquely, where the axis is inclined with respect to the surface. Obliques for mapping are usually taken at such an angle that the apparent horizon is included near the top of the field of view. Obviously, an oblique covers a great deal more ground area in a single picture than a vertical from the same altitude, but it is equally clear that detail on the ground is lost as distance from the camera is increased, and that perspective introduces distortion in dimensions that makes direct usage for mapping impossible. Line maps may be plotted from obliques by superimposing on the photograph a perspective grid and transposing the out-

lines of topographical features point by point to a rectangular chart, or oblique negatives may be rectified by a special photographic process to be described later This method has been widely used in surveying large unexplored areas in the Dominion of Canada.

Vertical pictures were first used for mapping because of minimum distortion. Where they are taken at short intervals along a line of flight (so that each picture overlaps the preceding one approximately 60 per cent) it is possible to piece prints together so that a continuous vertical picture of many miles of country may be obtained. By covering a given area by a series of flights parallel, and close enough together so that each strip overlaps adjacent strips some 45 or 50 per cent, a large picture, or *mosaic*, may be assembled The area covered by each exposure depends on the focal length of the lens employed, and the altitude from which the picture is taken A 12 in lens working on a 7x9 in plate covers a ground area 2,916 x3,750 ft (approx 0.4 sq mi) at 5,000 ft and 8,750x11,250 (approx 3.6 sq mi) at 15,000 ft At the latter altitude, a 10 in lens takes in an area 10,500x13,500 ft (approx 5.1 sq mi)

Multiple lens development

In commercial surveying work, or on military reconnaissance missions the time element has become increasingly important As a means of covering many times more ground with a single exposure than is possible with a single lens, the multi-lens idea evolved long before the War Capt. Theodore Scheimpflug of the Austrian Army designed the first camera of that type, which embodied the principles still used in the most advanced models It consisted of a central vertical lens surrounded by seven oblique lenses, but difficulties were encountered both in construction and operation, and the apparatus was never considered satisfactory In 1918, Maj James W. Bagley of the United States Army Corps of Engineers developed the first multi-lens camera to come into extensive use, a three-lens machine which was later adopted by the U S Army for general military and governmental survey use It consisted of a vertical camera and two obliques taking pictures at right angles to the line of flight. The two wing pictures were rectified in a special printer (see below), and combined with the central vertical gave the effect of a vertical picture over a strip of territory much wider than was possible to cover with a single lens. The number of flights over a given territory may therefore be greatly reduced.

In transferring data from photographs to maps it has been found desirable to extend the so-called "air-base," or the line connecting adjacent picture centers, through several successive pictures. For this reason (about 1927) a fourth lens was added to the Bagley type camera, giving an extension in the line of flight to act as a sort of rudder to align a strip of photographs.

The five lens camera

The search for greater coverage per picture, and the success of the four lens equipment led inevitably to the five-lens machine which represents the latest development in aerial photography The Fairchild T-3A camera has been in active service for about two years and has been used in making a number of important surveys, including that of the State of Massachusetts mentioned earlier. It consists of five separate camera chambers, one vertical and four obliques spaced 90 deg apart Although the included angle of each lens may be as much as 60 deg it was determined that the total included angle of the four cameras along or across the line of flight should be 140 deg. This arrangement yields a sufficient sharpness of image for the identification of ground features for control purposes even in the extreme portions after the necessary distortion to bring the obliques to the same scale as the vertical The addition of the fifth or head picture makes possible the holding of the azimuth of a strip of pictures even more accurately than with the 4-lens arrangement, a condition which has proven to be extremely valuable in photographing localities where little ground control is available The coverage of the five-lens camera (focal length—6 in) is approximately 126 sq mi from 15,000 ft : a figure which should be compared with the data given above for single-lens cameras

Rectification of obliques

The principle of optical rectification of oblique photographs dates back to Scheimpflug's experiments with multiple cameras about 1903 Virtually the same methods are in use to day in the most modern equipment used with the 4 and 5 lens cameras The rectifying printer consists of a rigid, light-proof box fitted with a copying lens and two focal planes (one for the negative and one for the sensitized printing paper), the latter set at predetermined angles to the plane of the lens to counteract the distortion in dimension introduced by taking the original oblique. Thus, instead of superimposing a perspective grid on a contact print of the oblique and reconstructing the topography graphically, the printer actually produces a picture in which the effect of perspective is eliminated The optics of the transforming printer are shown in the sketch The reason for the curious Maltese cross effect of the assembly of the contact printed vertical and the rectified wing obliques is obvious

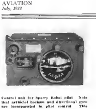
By whatever methods survey photographs are obtained, however, they are not maps, but only pictures of certain sections of the earth's surface. They are simply the basic data from which the cartographer works In rare cases the picture may serve satisfactorily as a map, but it must be realized that it may be subject to serious errors in scale due to tilt and relief effects Unless adjacent prints are examined carefully under a stereoscope, changes in elevation of the ground are not apparent. Contours are totally lacking There is also nothing to indicate the names of towns, streams, railroads, etc., nor are types of road clearly indicated All such information must be added before a true map results.

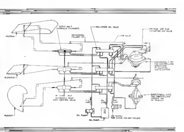
Ground control

Perhaps the most important consideration in the making of maps from photographs is in the identification and selection of certain fixed reference points or controls The more points whose location, elevation, etc , are accurately known that can be included in the pictures, the easier the task of assembling overlapping exposures accurately Controls are usually established from ground surveys. Useful data may be obtained for this purpose from such governmental sources as the Coast and Geodetic and Geological Surveys, or the U S Corps of Engineers In territory not already covered by published surveys it may be necessary to send parties into the field to establish the necessary fixed points Once suitable controls are established it is possible to proceed with the construction of scale maps from photographic data The five lens camera has an important advantage over single lens types in this connection, for the number of controls required is reduced by about 80 per cent

Aside from purely military work for its own purposes, the Army Air Corps is continually assisting in collecting data for Geological and Coast and Geodetic Survey maps Not only are uncharted areas being covered but existing maps are being checked and brought up to date The use of the five-lens equipment has reduced the Army's cost per square mile of area photographed by some seventy-odd per cent

It is impossible in such brief compass to discuss the details of method or procedure for the making of aerial maps, but a number of excellent works are available which will be found very helpful Captain Ashley McKinley's "Applied Aerial Photographs" and Topographical Survey Bulletin No 62, "The Use of Aerial Photographs in Mapping," issued by the Departmet of the Interior of the Dominion of Canada are good sources of information The Fairchild Aerial Camera Corporation manufacturers of much of the photographic equipment for the U S Services has published a number of bulletins describing its various models, and is shortly to release a new text book covering aerial mapping with multi lens cameras in great detail





Control unit for Sperry Robot pilot Note that artificial horizon and directional gyro are incorporated in pilot control This unit is designed for instrument board mounting Right Schematic lay-out of latest Sperry gyro-hydraulic automatic pilot.

Airplanes that fly themselves

The Robot makes flying smoother and safer for the passenger and affords welcome relief to the human pilot

A STIFF Atlantic breeze tore at the fringes of low-lying clouds and marshalled serried ranks of white-capped rollers against the sandy hulwarks of Long Island. At two thousand feet, Wiley Post's trim Lockheed "Winnie Mae" drilled along with arrow like precision with scarcely a wobble to show for the rough air outside It was obviously a superb job of piloting A glance through the open cockpit door, however, disclosed Post relaxed in his seat, arms folded feet off the rudder pedals doing literally nothing but watching the scenery The answer was to be found in a small black box trimmed with two open faced dials and an assortment of small knobs mounted in the center of the instrument board It contained the "brains" of Sperry's latest Robot pilot a machine with almost uncanny ability to hold a course and smooth out bumps It seemed to see the gusts approaching, damping the most violent down to gentle tremors It made little ones out of big ones

To ride as a passenger with the robot was a most convincing demonstration. Heretofore, like a Roman galley slave, the pilot has been virtually chained to the controls, never able to leave his seat to manipulate satisfactorily his navigating instruments, maps or radio or to relieve cramped and aching muscles. After many hours of flying under such circumstances, a landing even under good conditions may become extremely hazardous for mental and physical reactions have been made sluggish from fatigue at a time when they should be at the highest pitch With an automatic pilot, however, except for take off and landing the pilot is relieved of most of the physical labor of flying Since long-range flying is now not so much a matter of a mechanical breakdown of airplane or engine as it is physical endurance of the pilot, the automatic pilot may extend non-stop records materially as machines may be flown until the fuel supply is exhausted.

A job for Willie Robot

But Little Willie Robot has to do more that take part in long-distance record trials to justify his existence. He has to go to work. He has an important part to play in providing comfort and safety to those who go into the air in ships. The most conscientious pilot quickly tires of smoothing out the bumps in rough weather He is usually more concerned with keeping on his course than in waging a continual battle against minor changes in flying attitude for the sake of comfort to his passengers With the automatic pilot in operation, neither passengers nor pilots need worry over much about the bumps Smoother flying, coupled with the elimination of noise and vibration to the degree attained in 1933 transports (see discussion of new commercial types in recent issues of AVIATION)

will go a long way toward selling air transportation to the public

Fog, snow and darkness mean nothing to the intricate brain of the robot. Bad weather for the human pilot spells rigid concentration on instruments,—nerves keyed to the highest pitch—constant attention to a mass of detail that is most fatiguing when continued for any length of time. There is no let-up, —no opportunity for a moment's relaxation. It is not anticipated of course that pilots flying transport airplanes will ever leave their posts for rest and relaxation, but an automatic pilot will give opportunity to navigate and use the radio at some leisure and will afford welcome relief from the continual nervous and muscular tension which is present even in ordinarily good flying weather. It may become feasible to fly more high-speed schedules per day with a much higher degree of safety. It does not follow that the human co-pilot will be eliminated, for he constitutes a potent safety factor in the remote event of accident or sudden illness to the pilot. A mechanical installation, however may permit co-pilots to take over many of the duties now handled by stewards (duties which will probably be greatly increased with larger ships and longer passenger lists), without imposing a serious handicap on the chief pilot.

Constantin girouettes applied to a Farman monoplane.

An outline of history

Curiously enough, although the automatic pilot is now very much in the news, the idea is far from new. Almost from the beginning of successful mechanical flight the thoughts of literally hundreds of inventors have turned toward the problem of automatic control. Patent Office files in this country and abroad are choked with devices of all sorts for this purpose. As far back as 1909 the Sperry Gyroscope Company installed a gyroscopic stabilizer in a monoplane belonging to Stanley Beach. In the spring of 1914 Lawrence Sperry, whose untimely death in the English Channel in 1923 put an end to a brilliant aeronautical career, gave a series of spectacular demonstrations in Europe with an automatic pilot in one of the early Curtiss F boats. His efforts culminated in the awarding to the Sperry company the Grand Prize by the French Association for Safety in Aircraft.

Spurred on by the hostilities of 1914-1918, inventors saw possibilities in an automatically controlled airplane. Weird tales have been told (chiefly in adventure story magazines) of mysterious fighting planes maneuvering over the Western front firing machine guns with deadly effect without aid of human pilots. Authentic evidence is lacking for this phenomenon but the pilotless aerial torpedo although never actually used against an enemy was an accomplished fact by the end of the War. Since no air transportation prospects of sufficient magnitude to warrant further effort were in evidence at that time, active research on the problem was abandoned for almost a decade. With the tremendous growth of the airlines during the last few years, however, interest in automatic pilotage has been revived and a large number of such devices have been built and tested here and abroad.

Stable airplanes

The first, and perhaps the most obvious approach to the problem was to design airplanes with great inherent stability. It soon became apparent, however, that a highly stable airplane was far from desirable, for such machines can be flown satisfactorily only under reasonably good atmospheric conditions becoming difficult to manage in gusts. Modern designers attempt to develop ships that are just stable enough to be flown comfortably in good weather, and yet yield the highest possible degree of maneuverability consistent with the service for which they are intended.

Many inventors considering the problem of automatic pilotage hit first upon the idea of the simple pendulum. Offhand, it would appear that a weight suspended somewhere in the airplane could be linked up to the controls in such a way that deviations from horizontal flight would operate them to restore balance. This idea is so beautifully simple that it appears from time to time even now, but what the inventors of such devices overlook is the effect of accelerations on the suspended mass of the controlling pendulum. The motions of an airplane in free flight are so many and varied that gravitational forces seldom act alone. To be of any use as an airplane control device, a pendulum must be stabilized by some means.

Air reference systems

Fundamentally an airplane derives its lift and controllability from the direction and velocity of the air flowing over the wings and control surfaces. This fact has led a number of inventors to the conclusion that the logical datum for automatic control devices is the air stream in the immediate vicinity of the ship. The French have been consistent protagonists of the use of air flow for automatic control. Étève, Constantin, and others have experimented at great length with control through *girouettes*, or small vanes exposed horizontally and vertically in the air stream connected to the flying controls. Other air reference systems, depending chiefly upon pressure-changes in the vicinity of wings as measured by pitot tubes or venturis appropriately placed, have been tried without much success.

Some use has been made of vanes or auxiliary surfaces in the air stream to operate stall warning devices, but general experience with such arrangements has been unsatisfactory and they have never been widely adopted. Various combinations of aerodynamic and pendulous controls have also been tried, but they result in extra complication and are subject to all the faults of the individual elements.

The chief disadvantage of any system of automatic control which is operated from the air stream lies in the relatively great time lag between the impact of the disturbing influence and the application of the correcting force. The control impulse is usually late in starting. Under very gusty conditions, disturbing forces may be changing very rapidly in magnitude and direction and the control surface movements may be entirely incorrect by the time they are actually applied.

Steering control

Before passing on to the discussion of the full gyroscopic automatic control, some mention should be made of another class of equipment which is concerned only with directional stability,—the automatic steering control. The sole purpose of this apparatus is to keep an airplane on some predetermined com-

pass course. It consists usually of some form of earth inductor or remote reading magnetic compass arranged to operate the rudder control through a relay and servo motor combination. In general, compass controlled steering gears, unless stabilized by some damping device exhibit "hunting" tendencies that make their operation unsatisfactory. Except in combination with the full automatic pilot, the automatic steering equipment has not been very widely adopted.

Sperry Gyro-electric pilot

The search for other instruments to indicate the attitude of an airplane in the air led Sperry back to the designs of the original gyro-controlled aerial torpedo. The gyroscopes were taken out of that device and developed separately as the artificial horizon and the directional gyro. The principal modifications in the gyroscopic elements themselves consisted of very material reduction in dimension and the abandonment of the electrical for the vacuum drive. The success of these two instruments coupled with the ever-increasing demand for comfort and safety in air transportation revived interest in automatic airplane control. An automatic piloting device was built and demonstrated successfully in the Army Air Corps late in 1929, and by the spring of 1932 Sperry had a workable outfit installed in a Curtiss Condor in regular service on Eastern Air Transport. The essential elements of this equipment were two gyros, one horizontal and one directional, both electrically driven. Any displacement of the airplane with reference to the gyros closed electrical contacts which energized solenoids controlling a reversing bevel gear train of the sawtooth clutch type. Three units of this sort were provided, one for aileron, elevator and rudder, all mounted on a common power shaft. The shaft was rotated by a small wind-driven propeller mounted on the side of the fuselage. The output side of each reversing clutch was geared to a drum around which the control cables from the movable surfaces were wrapped. A hand clutch between the drive and the drum was introduced to enable the pilot to throw the automatic control on or off. For convenience all three hand clutches were operated simultaneously by a single lever. To make the control surface movement proportional to the deviation from the course a mechanical follow-up gear was applied to the contactors.

The electro-mechanical type of control although demonstrating its practicability by many hours in the air, soon developed functional difficulties. Trouble occurred in maintaining the electrical contact system and the transmission of controlling power by shaft and bevel gearing was obviously cumbersome and expensive. The weight of the apparatus (about 110 lb.) was also felt to be excessive and work was immediately started on a complete re-design, using a fundamentally different system of control. In the original installation the gyros for the automatic pilot were completely separate from others used in the ship. In the new system, however, the automatic pilot is actuated by the same gyros used for the horizon and directional indicators.

Sperry Gyro-hydraulic system

Vacuum operated relays and hydraulic servo cylinders replace the electrical contactors and the mechanical power supply. As indicated in the diagram, the appropriate axes of the gyro gimbals carry semicircular disks which cover or uncover compressed air discharge nozzles in the ends of the pick-off levers, and act as control valves. Since there is no actual contact between the nozzles and the disks, there are no upsetting forces imposed on the gyros. As will be noted in the diagram, the air connections from each pick-up pass to balanced relays, where each is connected to a chamber on opposite sides of a flexible diaphragm. As long as the pressures in each chamber are equal, there is no movement of the diaphragm, but when the valve disk on the gyro axis uncovers one nozzle of the pick-off and covers the other, the diaphragm of the relay is distorted toward the low pressure side. The movement is transmitted to a piston valve which controls the direction of flow of oil in the servo cylinder circuit. The cylinders are simple double-acting piston devices connected through cables to the airplane control surfaces. Compressed air for the operation of the gyros and the relay control is obtained from a small engine-driven compressor, and the high pressure oil for servo operation from an engine-driven pump of the gear type. Each servo cylinder is provided with a bypass valve to throw the control out of operation. As with the mechanical throw-out, all three valves are connected to a common operating handle.

Both in weight and compactness the new hydraulic automatic pilot is a great improvement over the previous electro-mechanical. The entire installation weighs about 75 lb. The gyros, pick-offs and relays are mounted compactly in a box approximately 10x12x20 in., mounted on the instrument board. The indicating dials for the horizon and directional gyro are integral parts of the mounting case. The omission of these instruments (15 lb.) makes the net increase in weight due to the installation approximately 60 lb. The hydraulic servo cylinders may be installed at any convenient point in the cockpit where the main control valve is within easy reach of the pilot.

As with the mechanically operated automatic pilot, the hydraulic arrangement may, if necessary, be overpowered by the human pilot in emergencies. Although it may be put out of action entirely in a split second by manipulating the throw-out handle, the control stick may be used in the normal manner even with the automatic pilot in full operation. Somewhat greater force must be applied, but at worst it is well within the range of physical capability of the average pilot. One of the chief advantages of the new over the old system is the fact that an automatic course-setting control has been incorporated. It is only necessary to set the required compass bearing on the directional gyro, checking the course from time to time from magnetic compass readings or from landmarks. Three small knobs on the face of the instrument permit the pilot to make any desired change in the altitude or direction of the airplane through the automatic control without the use of the stick.

Many inventions

Besides the pioneering effort and continuous work of development in the field of gyro-controlled automatic pilots by Sperry in America, Boykow in Germany, Marmonier in France, and the British Air Ministry are known to be working on similar devices, but few reports are available of successful use or extensive application. The Air Ministry's equipment is operated from air-driven gyros through compressed air servo cylinders. The air supply to the servos is controlled by piston valves directly connected to the gyro gimbal ring and frame. A propeller driven compressor supplies the necessary air. One squadron of twin-engined bombing aircraft of the British air force is said to be equipped with automatic pilots, and one of these devices was installed on the Fairey monoplane which set the present long distance record. Reports indicated however that "George" (as the British have nicknamed their robot pilot) went out of action long before the end of the flight. The behavior of the Sperry equipment on United Air Line transports and on Wiley Post's projected round-the-world attempt of the near future will be watched with a great deal of interest.

The fast transcontinental flight of Commander Frank Hawks in his Northrop Sky Chief on June 3, 1933, called attention to a new automatic pilot designed by George deBeeson of Huntington Park, Cal. Few details are available at the moment concerning the equipment, but reports indicate that it is vacuum operated from some sort of stabilized pendulum (non-gyroscopic) and incorporates an automatic steering control actuated by a compass of the earth inductor or magneto type. Although the device is yet undergoing its early flight trials, Commander Hawks stated that it performed satisfactorily on his cross-country flight. It is hoped that a full description will be available to our readers at an early date.

EDITORIALS

AVIATION

EDWARD P WARNER, *Editor*

Industrial recovery and the aviation business

ON JUNE 15 President Roosevelt placed his signature upon a document which has been variously described as "the herald of a new era," "the first long step toward Bolshevism," "a charter of liberation for industry," and "a horrible example of what comes from trusting professors." Before the Industrial Recovery Bill was enacted into law it had probably been more discussed, more admired and more damned than any other single piece of legislation in the last 40 years. For better or worse, it is now in our midst. It cannot be ignored. It cannot be circumvented. It must be frankly met. It must be met by every branch and fraction of American industry, and in particular by the industry that is concerned with the building of airplanes and their parts and accessories.

No one yet knows exactly how this spectacular adventure in social economic legislation is going to function, but a few things are clear. The first is that trade associations are henceforth to be virtually a part of the government of the nation. It will henceforth be essential that each industry shall have some agency through which it can speak as a unit. In the Aeronautical Chamber of Commerce, if that is to function as the industry's association, machinery must be created for developing rules and standards which the aircraft industry as a whole will accept. The Chamber's membership must become more fully representative of the whole body of aircraft manufacturers. The Chamber must be reorganized to meet present conditions and to prepare for the assumption of new responsibilities, and that process, as recited in our news pages, is already under way.

The first need is that this industry shall stand united, and that all internal rivalries and strife shall be subordinated to the common good. We need now as never before to avoid any appearance of individual gumshoe work or individual lobbying, or of attempts on the part of any one firm to make use of the legislative and political situation to outmanoeuvre the rest. There are only two ways in which government officials, and particularly the officials engaged in administering the Industrial Recovery Act, should henceforth be approached on behalf of the aircraft industry. Either the industry should select an individual who is generally trusted and who has no commercial interest, and empower him to speak for them and negotiate on their behalf, or it should be represented by a committee of leading executives of the leading companies, appearing as a unit and speaking with a single voice. This is not a new subject with us. We have made similar recommendations before, but what might have been offered as mild recommendations a year or two ago have now to be urged and pled for with evangelical fervor as the very minimum essentials for the preservation of the soundness of the industry's position.

SO MUCH for general principles. Now take a look at the language of the act. It gives us the right, through a code approved by the President, to stop irresponsible price-cutting. It gives us the privilege of defining and prohibiting unfair practices in selling. It holds out the prospect of a substantial new expenditure for military and naval aircraft from the funds provided for new public works. While the exact sum to be spent for aircraft is not defined nor limited in the act, it seems reasonable to assume that it will not be less than $16,000,000, and it may readily be more.

On the other hand, the new act creates a new relationship between manufacturers and their employees. It makes the government a party to all labor relations. It serves notice upon all industries (and certainly the aircraft industry has up to the present time been one of the least of offenders) that wage-cutting is at an end. It indicates a probable insistence that the maximum hours of labor be materially reduced, very probably to 36 per week or less. So far as the labor employed upon the construction of the aircraft purchased under the newly available public works money is concerned, in fact, a definite maximum of 30 hours per week is established.

We are presented with problems of a new and extraordinary nature. We can solve them. The Industrial Recovery Act is intended to be what the name implies, and it should contribute to recovery in the aircraft industry as well as elswhere. But it will not contribute to recovery, and it will do us no good, if we start with any illusions. Congress has done its work and adjourned. An organization to administer the law has been set up. Now the aviation industry must move without a moment's delay to organize or reorganize, to mobilize its best talent and to draft its code of fair competitive practice and its accompanying code of labor relations, with no thought in mind except that the greatest good of the industry as a whole shall be promoted.

AVIATION sponsors the quest for a record

THOUGH soaring flight no longer casts the spell over the aircraft industry that it did in 1930, when there were bright hopes of building fifty thousand gliders and teaching a million American youth to fly, it has just as much real importance for the industry today as at any time in the past. It still provides a useful form of experiment on motions of the air. We owe a great deal of our present knowledge of vertical currents in the atmosphere to the extraordinary researches of German soaring pilots and the scientists who have worked with them. Soaring still offers a specialized form of aerial sport which may well be practiced by increasing numbers of those who fly airplanes for transportation and who use a soaring glider as they would use a sailboat, for sporting competition testing to the utmost the skill of the participants. Finally, soaring in its milder forms and under proper supervision still offers cheap and effective means, accompanied by but little danger, of introducing young people to aviation and of keeping them in the frame of mind that will make them and their friends good customers for airplane salesmen as soon as their resources permit. That the glider can be safely and properly used by young people and that it has immense interest for them has been proven on many occasions, most particularly by the work that Arthur L. Lawrence has done with large groups of boys in Rhode Island and in other parts of New England.

We on AVIATION believe in the future of gliding and soaring, not in the preposterous mass-production terms of three years ago but as a sport and a science which deserve encouragement for their own sake and which are of very definite importance and benefit to builders of aircraft and operators of air transport. Two years ago we proved our interest in the subject by presenting prizes for the altitude competition in the national soaring meet at Elmira. Within the next few weeks another meet is to be held from the same hills that were used in 1931, and we are again putting a prize in competition,—an award to be made for the first flight from the hills around Elmira to a landing place within 25 miles of AVIATION's offices in New York City. If the flight is not made during the Elmira meet in July, the offer will remain open, under the supervision of the Soaring Society of America, until the end of the present year.

The distance from Elmira to New York is approximately 160 miles. Though well in excess of the present American soaring record, it exceeds by only very little a great many of the flights that have been made in Europe. We are anxious to see soaring progress in the United States. We believe that one of the surest ways of encouraging progress will be through the establishment of some really spectacular records, at least upon a parity with the best European figures. To concentrate attention upon planned long-distance cross-country flying from point to point, which involves the highest development of the soaring art, we are making our offer. We make it in the definite hope and the reasonable expectation that the prize will be won, and when it is we shall feel very proud to have had some part in stimulating an achievement which we believe will be of very real value to American aviation.

Lo, the poor private pilot!

AS AN ALMOST universal rule, in almost every state and country, the automobile that is to carry passengers or freight for hire receives a distinctive type of license and bears a distinctive type of number-plate. It, and its driver as well, must often meet special requirements going far beyond those imposed on purely private operation. A motor boat that is to ply for hire is subject to special rules and to a particular type of government inspection.

But with aircraft no distinction is recognized. The NC license that goes onto a private plane, never flown by anyone except the owner and never used for a commercial purpose, is exactly the same as the license that goes onto the machine that is kept in daily service in taxi work or in carrying sight-seeing passengers. There is no difference between them in the requirements for relicensing. There is no difference in the frequency of re-inspection that is legally exacted.

Seven years ago last month the Department of Commerce was charged by law with the supervision of civil aviation. The personnel of the new-born Aeronautics Branch undertook to make flying safe. They have had remarkable success, particularly in the transport field, where the co-operation of operators and government has brought the hazard very nearly to zero. But now the time has come for reconsideration, in the light of seven years' experience, and for deciding how far the Federal Government's responsibility for the safety of every aircraft that flies should extend.

We have been considering that question for some time. Now we propose a new rule. We suggest that the government has four obligations in connection with safe flight: (1) to protect the general public on the ground, (2) to protect the passenger in a commercial plane, (3) to protect the careful pilot from the careless or reckless one, (4) to protect everybody concerned, to a reasonable extent, from being exploited or defrauded

Just those four. No more. Under no one of the series is it possible to justify the present handling of private planes and private pilots

ONCE each year, it now becomes the duty of every owner of a licensed airplane to get it to a Department of Commerce inspector for re-examination and re-licensing. If the owner is a business man, and if he doesn't happen to be near an airport at which an inspector makes regular calls, he can either leave his business to take the plane to the inspector or he can hire a pilot to fly it to inspection headquarters. Both are inconvenient, and time-consuming, and expensive. The *public* danger from an airplane with a bad wing spar is not one-tenth part of that which comes from an automobile with bad brakes, yet the airplane is subjected to a re-licensing rule that no one ever thinks of imposing on the automobile. Aircraft have now reached the point where they ought to be put at least on a common footing with other vehicles that constitute a far greater menace to the innocent public.

In the one-year intervals between license renewals, every plane must be checked over by a licensed mechanic at least at seven-day intervals. Good practice, to be sure. A practice that most owners would no doubt observe of their own accord. But not, we suggest, a practice that the Aeronautics Branch as the guardian of *public* safety should be charged with forcing upon every owner.

Every time the plane is flown, even though no one but the owner ever flies it and he never flies any other machine, the fact must be recorded. It must, in fact, be recorded repeatedly, for regulations require that airplane, engine, and pilot each have a log-book. In commercial operations, or for pilots who hold or who expect to seek commercial employment, all this paperwork is genuinely valuable. Exacted from the private owner-pilot, it isn't worth the trouble it makes. It doesn't seem to us any more the business of the government to make every pilot keep up his log-books than it would be to prescribe that every farmer should keep a diary.

SO MUCH for the airplane. Now consider the pilot. Before he can even take his first lesson, or get any idea of whether or not he is going to like it, he must go to a doctor, and not to any doctor of his own choosing (as in certain European countries), but to one that is picked out for him, and take a physical examination. At one-year intervals after securing his license he must return for re-examination and license renewal. The private pilot has to meet a standard that finds no parallel in qualifying for the operation of any other vehicle except a passenger locomotive. Yet, again as in the case of the airplane, the *public* hazard involved is much less than that in the case of the automobile. A pilot with bad ocular muscle balance *may* crack up on landing, and may injure himself. That's too bad, but it is no function of government to save its citizens from the consequences of trying to exceed their own powers. The only *public* danger from a pilot with bad vision is the danger of collision, and it does not need a specially-trained M.D. to identify vision so bad as to offer a hazard there. Any layman can do it. The collision risk depends on psychological qualities rather than physical ones—watchfulness and judgment rather than keenness of vision. Precise depth perception is a much more important factor in avoiding collision on the highways than in avoiding it in the air. The state policeman gives the physical tests for new drivers in most states. An equally simple test is all that is needed for a private pilot, if the government is to confine itself to making sure that there is no special likelihood of his injuring innocent bystanders, and it can be given by the same inspector who checks up on flying ability and (most important factor of all from the public-safety point of view) on knowledge of the air traffic rules.

NEEDLESS to say, our object in all this is not to increase the number of airplane accidents, but to stop punishing the innocent along with the guilty. Undoubtedly, if the restrictions be relaxed a certain number of bad pilots will slip by. Undoubtedly, too, the number of highway accidents could be substantially reduced if every motorist were required to pass an aviation physical examination once a year and have his car inspected once a week. But we believe that relaxation of the restrictions is quite possible without measurable increase of danger to anyone except the bad and reckless pilots themselves and those who knowingly ride with them as guests, and we believe that any reduction in the formalities attached to aviation will result in bringing in a great many new pilots and owners who may well be quite capable of meeting the present standards but who simply will not be bothered with proving and reproving their capacity.

Our proposals imply no criticism of the Aeronautics Branch. They have done a magnificent job in a field where it was badly needed. Our protest now is simply that they have been led into trying to do too much in a particular part of the field where not so much is necessary. This seems like a good time for a change of policy that will reduce the regulation of private flying to the absolute minimum consistent with the interests of the general public. It is a particularly good time for a change, because the threat of declining military purchases, taken together with the improvement in general business and the revival of optimism among business men and investors, holds out the prospect of a rather rapid increase in the relative importance of the private market if that market is properly handled. We believe that the Department would consider such a change with an open mind, and we believe that it can be accomplished if the aircraft industry and the private owners of aircraft will get together and show a little interest in the subject.

NEWS OF THE MONTH

The Chamber reorganizes

ANNOUNCING a widespread reorganization of the Aeronautical Chamber of Commerce to keep pace with the new obligations which trade associations must bear, T. A. Morgan, president of the Chamber and also president of the Curtiss-Wright Corporation, revealed the plans for a change in the organization's management. "It has been plainly necessary for some time," said Mr. Morgan, "that the Chamber's activities should be increased and in some respects modified, and the matter has been brought to a head by the President's new program of industrial recovery. A special meeting of the board of governors has been called for June 30 to complete the arrangements. In the meantime Leighton W. Rogers, for a number of years in charge of the Aeronautics Trade Division of the Department of Commerce and actively engaged in promoting American aircraft exports, has come to New York to associate in the work of reorganization of the Chamber." Though no formal statement can be secured pending the meeting of June 30, it is understood that officials of the Chamber plan that Mr. Rogers is to undertake the general direction of the organization's activities.

United speeds up

Shortly after noon on June 11, one of the 40 new Wasp-powered Boeing transports now in service on United Air Lines took off from Newark Airport to inaugurate new schedules which cut seven to ten hours from previous coast-to-coast flying times. Twenty-one and a quarter hours later ten passengers landed at San Francisco's Oakland Airport, first to make the through trip which is now being flown three times daily in each direction. The eastbound flight is even shorter, generally favorable prevailing winds permitting a scheduled time of just under twenty hours. Chicago to New York is a 4½-hour trip for the Boeings which make six of the eight flights each way daily. Fords make the other two in two hours more, with the westbound flight slightly longer for both types.

Many cities off the transcontinental track also are receiving faster service by Boeings. Flying time from Fort Worth, Dallas, Oklahoma City, Tulsa and Wichita to New York is cut 2½ hours, from Kansas City to New York one hour below previous schedules. In addition, equipment released from through services by the new Boeings is being used for extra schedules on many connecting and feeder routes.

More Condors

Their performance on the new fast schedules of American Airways and Eastern Air Transport has resulted in follow-up orders for eleven more of the new Wright-Cyclone-powered Condor transports, of which nine have already been or will soon be completed at the Curtiss-Wright plant in Robertson, Mo. Total bill for the twenty transports of which nine belong to American Airways, nine to Eastern Air, and two to the Air Corps for use of government officials, is $1,250,000.

Automobiles to fly

American Airways whose air express traffic reached a new high point of 27,604 lb. during May, more than twice the figure for the same month last year, is making plans to carry almost half that weight in a single plane. New type freight planes capable of carrying 12,000 lb. of freight on long flights are to be built by Stinson Aircraft Company. Designed to accommodate three 2-ton or four smaller cars fully assembled except for wheels in its cabin, the aerial box-car is to be twin-engined and all metal, with a cruising speed of 80 and a top speed of 100 m.p.h. This is the first airline bid for the heavier payloads usually handled by railroads and other surface transportation.

Exposition air service

Special provision for pilgrims to Chicago and the Century of Progress Exposition being staged there have been made by most of the lines serving this hub of national air traffic. A new limited service between New York and Chicago stopping only at Philadelphia and Pittsburgh has been added by Transcontinental & Western Air. The westbound plane, called "The Air Century," leaves Newark at noon to arrive in Chicago at 6 p.m. while the eastbound "Pennland" with a 1 p.m. departure from the exposition city reaches New York at 8.30 p.m.

To provide better connection with the new American Airway and United Air Line schedules from both coasts as well as to allow Chicago visitors a longer day at the Fair, Northwest Airways has delayed the departure of its afternoon and evening planes. These will take off for the Twin Cities at 4.30 p.m. and 2 a.m. Popularity of the night schedule has warranted the replacement of the small planes previously used on it by the 14 passenger Fords which fly the day time runs.

Air services cooperate

Island Airways, which last year operated the first air service in direct co-operation with a coastwise steamship company, has been taken over by Maine Air Transport. Its 46-minute schedules from the New England Steamship Company's New Bedford terminal to Wood's Hole, and the islands of Martha's Vineyard and Nantucket will be maintained in addition to the world's shortest shuttle service between Wood's Hole and Vineyard Haven, 6 miles away. (Air Ferry's San Francisco-Oakland service was 10 miles long.) M.A.T. will also continue its service in Maine between Rockland and the islands of North Haven, Vinal Haven and Mount Desert, on which 23,000 vacationists have travelled in the past two years. Fairchild 71's fly both routes.

The Roosevelt International Mercantile Marine Company is co-operating even more extensively with air transport operators. Its offices throughout the world are under agreement to serve as booking agents for Pan American Airways, whose passengers may ship heavy luggage by the company's Panama-Pacific line to Havana and Panama, ports of call for both steamship and air line, at the rate charged regular passengers for excess baggage. In addition I.M.M. is sponsoring special rate circle trips to Havana and through the Canal from any point on a transcontinental airline, overland travel to the New York and west coast terminals of the Panama-Pacific line being made by air.

More flying pay

After more than a month of jockeying back and forth between House and White House, Conference and Senate, where it for a time seemed permanently blocked, the Independent Offices Appropriations bill finally became law on June 16. Among its 46 surviving amendments was that empowering the President to modify or cancel air and ocean mail contracts, provided that the contractors affected be allowed a public hearing within 60 days preceding such action. The clause limiting flying pay in the services to $1,440, contained in the bill as passed originally by the House (AVIATION, June), was finally removed to give the President a free hand in his control over flying pay. Another afterthought was an amendment by Senator Black placing a limit

of $17,500 on the salary to be paid to any official of any air line receiving government subsidy

A Navy three-year plan

On the other side of the aeronautical ledger is the inclusion of two aircraft carriers among the 32 vessels for which allocation of Industrial Recovery Act funds has been approved by the President Completion of these carriers would leave the U.S. Navy still 25,000 tons light of the limits placed on carriers by the London Treaty. An additional allotment of $9,362,000 to build 290 airplanes essential for this additional fleet, scheduled for completion within three years, was made shortly afterwards.

Also cheering was the withdrawal of economy orders issued on May 15 to place aircraft as well as surface fleet on a one third rotating reserve basis. Naval air squadrons are to be kept in full commission.

New names at the departments

On the eve of his departure for a vacation, President Roosevelt made several appointments, forwarding plans for the reorganization of the Department of Commerce He selected to succeed Col. Clarence M Young as Assistant Secretary of Commerce in charge of civil aviation and the new Bureau of Aeronautics which is to replace the Aeronautics Branch, Ewing Y Mitchell of Springfield, Mo. Also under Mr. Mitchell's jurisdiction will come the Bureau of Lighthouses, from which the establishment and maintenance of airways was recently transferred to the Aeronautics Branch, the Coast and Geodetic Survey, the Bureau of Navigation and Steamboat Inspection, and possibly the Shipping Board. Other appointments to the department were Major J Carroll Cone of Little Rock, Ark., once general manager of Commandaire, to head the Aeronautical Development division; Eugene L. Vidal, one of the originators of the Ludington Line's hourly New York Washington service, to head the Air Regulation division, John H. Geisse, formerly chief engineer of the Comet Engine Company, as Supervising Aeronautics Inspector, and Rex Martin as head of the Airways Maintenance and Construction division Later came the appointment of James C Edgerton who was with the air mail service when it was government-operated as executive assistant for aeronautics.

Colonel Young who had submitted his resignation early in March, but had remained in office at the request of the President until his successor could be chosen, has been an official of the Branch since its creation in 1926 and its head since 1929 Veteran pilot, with a long record in military aviation, he was a pioneer in American commercial aeronautics Gilbert G Budwig, Director of Air Regulation and one of Colonel Young's chief assistants, resigned at the same time.

Among the recently announced personnel changes at the Post Office Department is the appointment of Jesse M Donaldson, Post Office Inspector in Charge at Chattanooga, Tenn., as Deputy Second Assistant Postmaster General Chase C Gove, who has held that position since July 1924, has been made Assistant General Superintendent of the Railway Mail Service Stephen A. Cisler will succeed Earl B Wadsworth as Superintendent of the Air Mail Service. In the course of his 38 years' experience with the Department, Mr Cisler served as General Superintendent of the Air Mail Service at the time it was being operated by the government. Mr. Wadsworth has been made Assistant Superintendent of the Railway Mail Service.

Airship investigation

Five senators and five representatives sat down together to investigate the Akron disaster and the future of Navy lighter-than-air policies A succession of witnesses including Col. Charles A. Lindbergh, Brig. Gen William Mitchell, Carl B. Fritsche, former senator Hiram Bingham, Arthur Brisbane and a miscellany of metropolitan newspaper editors, and the editor of AVIATION appeared before them, presenting widely divergent points of view

Gist of their testimonies, reported by Col Henry Breckinridge counsel for the committee on June 10 placed responsibility for the Akron crash on the navigation of the airship into the storm conditions The committee's recommendations, approved by eight of the ten members, were that the Navy continue its maintenance and development of air ships, that a new airship be built to replace the Akron, that the Los Angeles be put back into commission for training and research pending the completion of a new training ship, and that the Lakehurst Naval Air Station, which has been ordered reduced to a bare maintenance basis upon the departure of the Macon for California, be the center for training and experiment with a staff of experts under the direction of an experienced airship commander, to insure the training and experience of airship personnel (a New Jersey senator was among the committee's most active members).

A supplementary report enlarged on the recommendations for training and training equipment, with special emphasis on the Navy policy of requiring sea duty for airship officers Lieut. Comdr. Herbert V. Wiley testified his approval of occasional sea duty by requesting it for himself He has been ordered to the cruiser Cincinnati as navigating officer Senator King of Utah, chairman of the committee and violently anti-airship, and Senator Johnson of California did not sign the reports

The Macon joins the Navy

Upon completion of the Macon's trial flights in June, the trial board, headed by Rear Admiral George C. Day, president of the Board of Inspection and Survey, recommended its preliminary acceptance After being commissioned at Akron, the Macon will proceed to the naval air station at Lakehurst for post trial examinations and last touches Sometime in October the airship will start for its Pacific Coast base and operation with the battle fleet

Navy buys

Tests by the Navy have resulted in the acceptance of Switlik Quick-Attachable parachutes (designed to remain in the plane to be attached to the harness of any pilot entering it), as standard equipment for Navy pilots An immediate order is for 25 white silk back-packs, while 450 more are to be made at the Naval Aircraft Factory in Philadelphia under patent licensing agreement with the Switlik Parachute & Equipment Company Another contract provides 26 chair-packs for the Navy's two Ford Transports The Department of Commerce, Richfield Oil of California and Standard Oil of Kansas have also ordered Quick-Attachables for their transport planes

Lubrication for both Army and Navy aircraft will be provided again by Sinclair Refining Company, under contracts recently awarded it for the third consecutive year The 231,800 gal of Sinclair Pennsylvania Government 120 Aircraft Engine Oil needed by the Air Corps during the 1933-34 fiscal year will be shipped direct from the Wellsville Refinery to 29 Army airports throughout the United States as well as to air depots in Hawaii and the Philippines The Navy contract calls for 1 400 000 gal of lubricants for the use of the whole fleet including surface vessels as well as aircraft

Calendar

July 1-4	National Air Races Los Angeles
July 1-4	American Air Races, Chicago
July 8	King's Cup Race Hatfield England
July 16-23	Fourth Annual National Soaring Contest, Elmira N Y
September	International Gliding Congress and Meeting La Banne d'Ordanche (Clermont Ferrand) France
Sept 1-4	International Gordon Bennett Balloon Race and Air Races Chicago
Oct 7-8	U S Amateur Air Pilots Association Charity Air Pageant Roosevelt Field Long Island N Y
December	International Rally Cairo Egypt
December 14	Meeting of the Federation Aeronautique Internationale Cairo Egypt

MID-ATLANTIC AIRPORT

Above The rebuilt carrier Westfalen where Deutsche Luft Hansa's South American mail planes will refuel and be serviced Above, left The 100-ft track from which a mail plane was catapulted 800 miles off the Brazilian coast in the first tests on June 6 Right Drag-sail from which incoming planes are hoisted aboard (Aviation, May)

Curtiss Attacks for the Army

Next addition to Army Air Corps equipment will be 46 new two-seater attack planes now building at the Buffalo plant of Curtiss Aeroplane & Motor Company Similar in appearance to the Curtiss A-8 Shrike, the new all metal monoplane A-12, is powered with a 700-hp R-1820F Wright Cyclone instead of the Prestone-cooled 650-hp Conqueror V engine used on the earlier model Slots in the leading edge and flaps on the trailing edge of the wing give a relatively low landing speed to the A-12, credited with better top speed than any attack now in use. Its armament is five machine guns and a bomb carried under the fuselage

The same company, through its affiliate, Curtiss-Wright Export Corporation, has just shipped a number of two seater Falcon observation biplanes to Colombia Equipped with floats and powered with 700-hp Cyclone engines, they have a top speed of 185 m p h

Consolidated Aircraft Corporation is completing an order of six special Fleet training planes for the Mexican government Powered with Kinner R 5 160-hp engines they are intended for the use of the Escuela Militar de Aviacion at Mexico City The Fleets will be ferried there by way of Laredo, Texas in July

Air race entries

Few names of new ships are to be found on such line-ups for the classic events of the National Air Races as have been made public The veteran Gee Bee No 11 victor of the 1932 Thompson Trophy race, and its sister ship No 7 are expected to be on the starting line for the Bendix transcontinental speed dash as well as for the Thompson event, for which the qualifying speed is 225 m p h. No 7 has a new 800 hp Wasp No 11 a new 900 hp Hornet engine Russell Boardman will fly one, Russell K. Thaw the other Re designed, rebuilt and powered with a new 625 hp Wright Whirlwind, the Laird Solution in which the late Charles W Holman won the Thompson Trophy race at Chicago in 1930 will be flown by Arthur D Knapp its present owner The Wasp Junior-powered Wedell Williams which placed second in the Bendix dash last year will have another try, with Lee Gehlbach at the controls

Outstanding among the new ships which may appear at the barrier is a low-wing, all metal amphibion designed and built by Major Alexander de Seversky The de Seversky now awaiting flight testing, is probably the only Bendix entry with a fuel capacity permitting a non-stop flight from New York to Los Angeles (A detailed description appears on page 224)

New planes mentioned for appearance in the 375 and 550 cu in events are those of Arthur C Chester, Gordon Israel, and Lee Schoenhair whose Menasco-powered racer was built by Alden Brown Israel and Brown were both present with novel planes in Cleveland last year (AVIATION, October, 1932) Many of the planes which finished in the money in 1932 are also expected to be on hand

Though the American Air Races are not sanctioned by the National Aeronautic Association, every effort is being made by their directors to avoid conflict with the National Air Races through emphasis on races for planes having A.T.C.'s and on different displacement classifications The A.T C races, one of which is flown each day, are for planes of 350, 500, 800 and unlimited cubic inch displacements, while the free-for alls are limited to 115, 350 and 500 cu in groups The purses offered total $20,000 In addition to the Chicago event the American Air Race Association is sponsoring some 50 air shows in other cities during the summer and fall

Considering the sportsman pilot

Non professional pilots were the concern of the Aeronautical Chamber of Commerce in working out its National Aircruise Plan. Prepared by the Aerial Service Section in co operation with the Airport Section the plan stimulates and assists in the staging of aircruises for private plane owners and sportsmen pilots Curtiss Valley Stream Airport staged the first aircruise in April, with ten planes making the group flight to Atlantic City Twenty one planes with 53 passengers participated in Lambert-St Louis Municipal Airport's cruise to

Bagnell Dam, in the center of Missouri a month later Many more of the 500 airports which received the plan have scheduled similar events for the benefit of local pilots during the next few months

Trans-continental record

Capt. Frank Hawks, whose previous records pointed the way to present fast schedules on the airlines, gave them a new goal in a recent non-stop flight from Los Angeles to New York Cutting some four hours from the previous record set by him four years ago, Captain Hawks made the 2,440 miles in 13 hours and 26 minutes Except on the take-off jump over the San Bernardino Mountains and after darkness covered the Pennsylvania hills a deBeeson automatic pilot had the controls

Speed on the continent

Dominating the 1933 European racing scene was the Deutsch de la Meurthe Cup Race established by the Aero Club of France in honor of its first president and lately revived to encourage fast flying in France Though the number of entrants at one time reached thirteen, only eight passed the qualifying trials Six appeared at the barrier to start the 1,240 mile race, flown in two stages of ten times each around a triangular 62 mile course from Etampes, a little to the south of Paris First plane across the finish line was the Potez-powered Potez, flown by M Detre at an average speed of 200.07 m p h M Delmotte's Renault-powered Caudron made 180.8 m p h and second place. The only foreign entry, a Comper-Swift with de Havilland Gipsy Major Special veteran of last year's King's Cup Race and flown by its designer Flight Lieutenant Comper, came in third An average speed of 179.6 m p h won the last Deutsch Cup race, flown in 1922 over a 186 mile course Allocation of the three-million-franc ($120 000) prize money, with special bonuses for French winners, has not been announced

Another imperial connection

Definite steps toward accomplishing a project which has been a bone of contention in British and colonial aviation circles for years are outlined in a plan now before the Air Ministry First will be taken in July, when Imperial Airways and India Transcontinental Airways co-operate to extend the present London-Karachi service on 1,550 miles further to Calcutta Through participation by the Indian Government with Indian National Airways and Imperial Airways in the stock subscription of Indian Transcontinental, its demands for control within Indian borders are satisfied Extension of the jointly operated route from Calcutta to Rangoon is scheduled for October to Singapore by the new year

Operation of the 2,500 mile leg from Singapore to Australia, upon the inauguration of which the British Government subsidy is contingent, presents the largest obstacle to completion. Though a new company, Australian Empire Airways, has been organized for the express purpose of providing the service from Malasia to Australia, it has found some opposition in the Commonwealth The subsidy which will begin with the opening of the final section and end on March 31, 1939, simultaneously with the termination of the present agreement for the operation of Imperial's England-Karachi route, will pay £40,000 the first year, £30,000 the second and third and £20 000 each of the last two years of operation Final survey of the route at least as far as Singapore, is now being made with one of the four-engined Armstrong Atalanta transports which probably will be used on the service

Union in France

Government economies in the matter of air transport subsidies was an outstanding motive for the consolidation of the five principal French air lines, recently approved by Air Minister Pierre Cot The new company will take over operation on Sept 1, under contract for fifteen years The projected 1933 subsidy of 182,000,000 francs (about $7,300,000) will save the government in the neighborhood of a million dollars over the individual allotments, Annual reductions in the amount of the subsidy are planned until 1938, when a revision of the contract will occur French executives, French equipment, and government permission for all stock transfers are specified in the contract. The merger includes Air Union with its lines to London, Marseilles, Geneva and North Africa, the Farman line to Berlin, Brussels and Amsterdam, CIDNA which connects Paris with Warsaw and the Balkan capitals Air Orient, carrying French colors to Saigon and the East and Aeropostale, holder of the South Atlantic mail concession M, Roume, once governor of French West Africa and chairman of Air Orient, is mentioned as president of the new line, with General Duval head of CIDNA, as assistant. Thus organized more successful competition with the single subsidized systems of England, Germany and the Netherlands is predicted in some camps though the French press is largely opposed to the plan

Another ocean jump

Falling short of the non-stop distance record but with the longest westbound north Atlantic flight to their credit Capt Mariano Barbaran and Lieut. Joaquin Collar landed in Camaguey, Cuba 39 hours, 55 minutes out of Seville Spain Their Breguet 19 biplane with 600-hp Hispano Suiza, Spanish-built according to French military specifications and similar to the Question Mark which carried Coste and Bellonte from Paris to New York in 1930 had 25 gal left of the 1 500 with which it took off The 4,600-mile flight, via Madeira and Puerto Rico, was only slightly shorter than Pangborn and Herndon's trans-Pacific jump Longest previous east-west Atlantic flight was made by two Italian officers five years ago in a special Savoia-Marchetti Their Rome-Pernambuco flight, though a world's record at that time, was across only 2,000 miles of water.

New controls in America

The Brewster Aeronautical Corporation of Long Island City, makers of seaplane floats and other aircraft components, are shortly to announce the Simmonds-Brewster system of flexible mechanical controls Developed abroad, this system has been adopted by many foreign users and is said to be in use in British airplanes

Airplanes and lighter-than-air craft are among the many phases of automotive engineering to be covered during the International Automotive Engineering Congress to be held by the Society of Automotive Engineers in Chicago from Aug 28 to Sept. 4 Among the speakers at aeronautical sessions will be J C Hunsaker of the Goodyear-Zeppelin Corporation, P G Johnson of Boeing Airplane Company, Jack Frye of Transcontinental & Western Air, and A A Adams of the United Aircraft Industries of the U S S.R. (author of an article on Russia's military aircraft which will shortly appear in AVIATION)

More 1932 reports

Reports of the result of 1932 operations continue to come in, showing for the most part a definite improvement over financial conditions at the end of the previous year, though losses are still the order of the day Fairchild Aviation Corporation and its subsidiaries incurred a loss of $52,675 after taxes, inventory adjustments, development costs, minority interest, depreciation and other charges This was only slightly more than half the loss reported at the end of 1931

Warner Aircraft Corporation, manufacturer of the Scarab line of aircraft engines was less fortunate during 1932 Its annual report showed a net loss of $173 302, as compared with $93,118 for the previous year

The net deficit reported at the end of 1932 by General Aviation Corporation and its subsidiary companies was little more than 40 per cent of the previous year's figure of $2 232,736 The 1932 deficit was $948 415 Of this amount $569 355 was loss from operations, while write-off of inventories and deferred expenses and other miscellaneous adjustments accounted for the remaining $379 059 Net operating

losses during 1931 were $861,819, when inventories and adjustments reached $1,370,916 During the past year an additional write down to estimated realizable value of real estate not used in operations was made to the tune of $782,340 and charged directly to the company's capital surplus account. Current assets at the end of the year of $2,634,572 included $1,104,973 in cash Current liabilities were $72,563

As a further step toward eliminating intercompany holdings by competing air transport operators, General Aviation, which earlier this year acquired control of North American Aviation through a stock transfer, more recently secured an additional block of stock in Western Air Express, bringing its holdings in that company up to 51 per cent

First quarterly reports for 1933 show not only an improvement over the same period of the previous year, but an actual profit. National Air Transport, United Aircraft and Transport Corporation subsidiary, earned $37,260 after expenses and taxes, or 6 cents a share on 650,000 no-par capital shares, as against a net loss of $6,750 in the first three months of 1932. Due to the sale of investments no deduction was made for federal taxes during 1933

Waco Aircraft Company's earnings amounted to 26 cents on each of 145,000 shares on the basis of a net profit of $34,310 after taxes, depreciation and other charges during the three months ended March 31 last. The company incurred a net loss of $36,416 after all charges in the same period last year

Personnel

As the Navy's new airplane carrier USS Ranger nears completion at Newport News, appointments are being made for its personnel. Comdr Charles Alan Pownall now head of the engine section in the Bureau of Aeronautics, will be its executive officer, while Lieut. Comdr Arthur C. Davis of the office of the chief of naval operations, noted specialist in aerial ordinance and air fighting tactics, will be head of the air department

Capt. Alford J Williams, naval pilot and specialist in high speed flight whose American airplane speed record of 267 m p h in 1923 remained unbeaten for eight years, has been made manager of aviation sales for the Gulf Refining Company

Air Chief Marshal Sir Edward Ellington has been appointed Chief of the Air Staff of the R A F, to succeed the late Air Chief Marshal Sir W Geoffrey H Salmond A pilot since 1912, Sir Edward was connected with military aeronautics during the War, was largely responsible for the creation of the Royal Air Force in 1918 out of the Royal Naval Air Service and Royal Flying Corps, and more recently commanded the British Forces in Iraq and the Air Defence of Great Britain.

SIDE SLIPS

By Robert R. Osborn

CONTINUING our usual custom of keeping AVIATION readers thoroughly informed on the latest news and progress in aeronautics we are passing along the most recent flying regulations for Egypt, just received from the Ministry of Communications, Aviation Department In case you were thinking of passing over Egypt on that trip you were planning for this summer, we'd suggest a thorough check-over of your engine,—top overhaul and new plugs and all that, as forced landings are not permitted The following portion of the regulations cover the problem of forced landings very effectively

"The attention of all pilots is directed to the fact that the landing of aircraft at places other than approved landing grounds and official aerodromes is prohibited Such landings may however be specially authorized In all cases when a pilot desires to land at a place where there is no approved or official landing ground, application is to be made to the Aviation Department on the special pro forma which is to be completed in detail and forwarded to reach this department not less than five (5) days prior to the

date of the intended landing The result of the application will be notified to the applicant and this formal approval must be received before a landing at the site is effected"

We were planning on doing a little barnstorming around Egypt very soon but will have to think the matter over a little longer, in view of the latest communication from the Ministry of Communications of that country He tells us that "Approval for the carriage of passengers for hire or reward at places other than official aerodromes will not be given unless the following equipment and personnel are made available on the ground (a) First Aid Equipment, viz 2 blankets 2 leg splints 2 arm splints, 1 roll splinting, 2 tourniquets, 6 bandages (8 cm) 6 bandages (flannel 10 cm), 2 bandages triangular, 2 packets gauze antiseptic, 6 100 gm packages of cotton wool absorbent, 250 gms lint, 30 cmc iodine, 500 cmc picric acid, 1 per cent solution, 500 cmc of hydrogen solution (b) 2 chemical petrol fire extinguishers (c) One person who has had experience and training in first aid"

On second thought we shall probably go ahead with our barnstorming trip as originally planned but shall change our sign to read, "Passenger Flights, $2.00, First Aid Service Extra, but furnished at a reasonable price to steady customers See our collection of leg splints,—none better in all Egypt"

Our hangar flying department

WE wish we could tell you the name of the pilot involved in this story, as you'd agree that the story is typical of him However, as he is somewhat bashful about such publicity and we haven't time to obtain his permission, we'll leave it to you to identify him if you can He is very well known as a test pilot, noted for his skill and courage, and, having saved his life with a parachute on one occasion, is a member of the Caterpillar Club He is equally noted for being somewhat bashful as we mentioned before.

When he was a boy a small circus made a one-night stand at the small town where he lived Among the acts in this circus was a hot-air balloon ascension, which was always a thriller, and popular with the boys in particular The balloonist had a rather large bag, and he advertised that he would take a boy along on his ascension, and pay him $10, if he could find a local boy willing to go along The scheme was to cut the boy loose with one parachute when the balloon had stopped rising, after which it would go still higher and the balloonist would cut himself loose in the usual manner As soon as he heard about this offer our hero rushed right around and succeeded in landing the job The ascension was made, and the parachute landings were completed without difficulty Our friend enjoyed the experience immensely, and had a thrill out of both the ascent and the parachute landing—but he didn't have nerve enough to go around afterward to collect his ten dollars!

FLYING EQUIPMENT

Major Seversky's novel amphibion

LIKE the mule and other hybrids, the amphibious airplane is often a clumsy critter, partaking of many of the vices and few of the virtues of its mixed parentage and tolerated not so much for its beauty as for its usefulness In airplane design beauty of line is frequently (although not always) an indication of quality of performance and, based on such a criterion, Maj Alexander Seversky's new amphibion shows signs of stepping beyond the average range of its class Although the ship has been in the air on several occasions no detailed figures as to its abilities are yet available Seversky has calculated however, that the stubby gold-lacquered low-wing monoplane, with its novel landing gear, will show speeds in the neighborhood of 190 m p h with the 420 hp Wright Whirlwind now installed, a figure which may be pushed to some 250 m p h with a Wright Cyclone F

Major and Mrs Seversky in the cockpits of the amphibion

Designed and supervised by Major Seversky and his engineers, the Sev-3 was built in the shops of Edo Aircraft Corporation at College Point L I There tools and experience with building sheet metal floats lent themselves admirably to the requirements of the work for the entire ship is of metal,—duralumin framing with Alclad skin assembled by riveting, with main fittings of chrome molybdenum steel

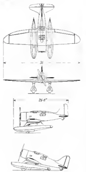
The outstanding departure from the usual practice lies in Seversky's design for landing gear He has attempted something that heretofore has never proven highly successful the incorporation of landing wheels in the bottom of seaplane floats His approach however has been unique for instead of following the usual procedure of building the floats as an integral part of the airplane structure and drawing up or extending the wheels as desired, the wheels have been made the more or less fixed element, and the floats are raised up out of the way to provide ground clearance The wheel travel is controlled hydraulically, but the position of the floats is dependent entirely upon gravity

Outwardly the floats are of normal appearance, but each has a slot cut through it from deck to keel just forward of the step large enough to clear a 24x6 semi low pressure landing wheel with hydraulic brakes With the float down and the wheel up the latter lies wholly within the float boundary, but again contrary to previous attempts at wheel-float combinations no effort has been made to close the well bottom by slides or trap doors The design has been subject to some criticism on account of the break in the float bottom, but towing basin and flight tests have indicated that the running and take off characteristics have not been impaired

Attachment of floats to wing structure are made through single built-up cantilever type main struts Each float is pinned to the free end of its strut in such a manner as to be able to swivel freely in a vertical plane parallel to the plane of symmetry A smaller strut aft acts as a guide and as a means of locking the floats down in the water landing position It carries a block on its free end which slides in a vertical slot in the pontoon

When the ship is in the air, the weight of the floats tends to keep them approximately parallel to the fuselage If it is desired to land as a seaplane, the wheels are retracted into the floats by operating a hand pump in the cockpit The upward travel of the wheels operates (through a suitably shaped cam) a locking device which pins the sliding blocks in the rear strut supports fast to the pontoon structure The floats are then rigidly connected to the airplane in the normal manner To make a landing on the ground the wheels are extended through the bottom of the float, a motion which is automatically accompanied by the withdrawal of the locking pins in the rear strut connections As long as the ship is in the air the floats retain their normal seaplane position but as the machine approaches the ground in a normal stalled

The Seversky fuselage under construction. Note the cut-out to clear the wing structure and also the built-in fin



The Sev-3 amphibion

landing attitude, the float tail wheels (built into the bottom edge of the water rudders) strike the ground first and raise the tail of the pontoons upward until contact is established at the ground by the main landing wheels The relative position of the float under the two conditions is shown in the two lower figures of the three-view drawing

The fuselage of the Sev-3 is of circular cross-section a true monocoque with Alclad skin over narrow ring bulkheads and stringers of dural The fin is built integral with the fuselage A 2 deg offset compensates for slip stream effect. The steel tube engine mount forward of the fire wall is suspended on rubber bushings An unusually deep N A C A cowl is fitted The present machine is arranged as a two seater, but the fuselage section is large enough at the rear cockpit to accommodate seats for four Sliding transparent covers permit flying open or closed at will. The seats are adjustable vertically so that the pilot may have the maximum possible range of vision for landing or take-off

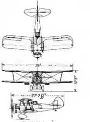
The wing is in one piece from tip to tip The underpart of the fuselage has been cut away to clear the wing structure and attachment is made through bolted fittings concealed under the fillet. The wing profile is based on the Clark Y modified slightly at the nose and with reflexed trailing edge The chief structural elements are five metal box spars

Chance Vought's new single-seat multi-purpose fighter, the V-80

Corrugated duralumin sheets (with corrugations parallel to the spars) are riveted along the top flanges under the skin proper and a smooth outer skin lies across the inner corrugated sheets to form the top surface of the wing. The under surface is stiffened by the use of transverse inverted U sections

The ailerons are of the skewed type statically balanced and rigged with a differential action to give 24 deg maximum up travel and 18 deg down. They are operated by a push-pull rod system. Aerodynamically the most interesting feature of the Seversky wing is the large trailing edge flap under the center section As can be seen from the accompanying drawings the flap is somewhat irregular in shape as the central portion of it fairs into the wing fillet Wind tunnel tests have indicated that the flap gives practically no interference effects over the tail surfaces The flap has a maximum travel of 45 deg downward and is operated by a crank and worm gear combination from the left side of the pilot's seat

So far, the machine has been flown only from the water but tests of the wheel gear are to be made shortly It has been announced that Major Seversky will use the machine in the Bendix Trophy Race on July 1



The V-80 Corsair

A Corsair Single-seat fighter

THE largest powers can afford extreme specialization of type in their air force equipment but many of the smaller nations, trying to stretch limited military budgets to the limit, show a decided interest in airplanes capable of performing a variety of military missions As a corollary under such a program of national economy the general facilities for the flying and handling of aircraft are likely to be limited, so that over and above the general utility question, machines may be forced to operate over rugged country where airports and maintenance facilities are few and far between Available fields are frequently small and rough and located in mountainous country at all sorts of altitudes, conditions which call for unusual performance characteristics.

To meet such specifications the Chance Vought Corporation of Hartford, Conn, has recently produced a military single seater of high performance adaptable to a variety of uses Following the Corsair tradition (the fuselage structure, wings, tail, landing gear and other items of equipment being interchangeable with the standard two seater Corsair) the machine is a biplane of normal appearance Its T1C-1 Hornet (700 hp at 2,000 r p m at sea level) gives it a top speed of 190 m p h as a land plane with full military load Its normal fuel load is 130 gal Omitting some of the military load, it can carry 173 gal of gasoline under which conditions it has a cruising range of somewhat over 800 miles Hamilton Standard propeller and Eclipse electric starter are standard equipment

The single cockpit is protected by a large vee type windshield and a sliding transparent cover The cover appears to be entirely open to the rear, there being no head rest or fairing to inter-

fere with the pilot's vision aft, an important point in a fighting machine. Presumably the effect of the slight increase in drag is over-balanced by the improvement in field of view It is interesting to note that a fillet of the type developed in wind tunnel tests for certain low wing monoplanes has been applied to the intersection of the lower wing panel and the fuselage.

The armament of the V-80 Corsair makes it a formidable military weapon Four fixed machine guns are mounted, two in the upper center section and two in the fuselage, all firing directly forward The upper guns are outside the propeller disk area and the two lower guns are synchronized to fire through the propeller All guns are electrically operated and selector switches are provided so that the pilot may use any or all at any one time. The trigger is mounted on the control stick Standard A-3 bomb racks are carried under the lower wings with controls in the pilot cockpit

As in the standard two-seater Corsair, provision is made for mounting a single float in place of the wheel landing gear when the machine is desired for seaplane service.

With foreign builders

Continuing our policy of offering a brief description of interesting foreign designs monthly the following concerns some of the ships taking part in the recent Coupe Deutsch Races

OF THE eight machines primed to compete for the Deutsch de la Meurthe cup on May 29, only three completed the twenty laps around the triangular course from Etampes, Chartres and Boncé Two machines were eliminated by crashes before the race, one resulting in the death of Captain Arrachart, well-known French pilot. Six machines actually started, but three were forced to withdraw during the course of the race.

Pilot Detre was first, flying a Potez 53-monoplane (Potez 9B engine) at an average speed of 200 6 miles per hour. This machine is a beautifully clean little monoplane of the low-wing type, fitted with fully retracting landing gear. Its length and span are 18 ft 1 in and 21 ft 10 in. respectively, and the total wing area is 77 5 sq ft. It is built mainly of wood. The fuselage is of circular cross-section in front, gradually tapering to an oval in the rear. The wings have wooden spars and ribs, and a three-ply wood covering The ailerons are arranged to function not only in the normal manner, but also as trailing edge flaps to reduce landing speed,

Second place was taken by Delmotte on a Caudron monoplane powered with a Renault engine developing 170 hp at 2 500 r.p.m This machine is also a low-wing type The fuselage is rectangular to accommodate the inverted engine Landing gear is not retracting, but the two wheels are supported on single struts cantilevered down from the wing structure outboard of the fuselage to give a comparatively wide tread Wheels and struts are inclosed in stream-line "pants" and fairing. The overall dimensions are 22 ft 4 in span, and 75 4 sq ft of wing area The gross weight is 1,530 lb. Delmotte's average speed on this machine was 196.4 miles per hour

Third and last place went to England's "Nick" Comper flying one of his standard Swift monoplanes fitted with a Gipsy Major engine This machine is of the type popular for single seat touring in England, and was not altered especially for racing It is a high-wing monoplane, strut-braced, with the normal split axle type fixed landing gear. It maintained an average speed of 148 8 miles per hour for the course

Of the ships that were built for the race, but retired for one reason or another, the Kellner-Bechereau was interesting in its extreme stream-lining. It is a low-wing monoplane with an inverted Delage engine developing 370 hp. The undercarriage was fully retracting, and was unusual in that each half consisted of a telescopic leg and a U-shaped member hinged at the fuselage. Retraction was accomplished by swinging the U-struts outward, bringing the telescopic struts inward, thus pulling up the wheels into the wing roots The Renault-engined Farman, also a low wing monoplane, exhibited a very interesting landing gear, a single retracting wheel under the center of the fuselage and two long wing tip skids to keep the machine upright on the ground Unfortunately, this ship was prevented from racing by the collapse of the undercarriage at the take-off.

NEW VOLUMES FOR THE SHELVES

Premier Congres International de la Sécurité Aérienne, *Rapports, Vol 3 Comite Français de Propagande Aeronautique, Paris 1932, 250 pages.*

THE THIRD of the volumes that contain the reports presented at the First International Congress of Aerial Safety held in Paris in 1931 The first two volumes appeared some time ago, and have previously been reviewed in Aviation The present installment is much like its predecessors, a miscellaneous collection of some 80 papers, most of them of French origin. The only American contribution is a brief note on airplane tires and tail wheels contributed by the Goodrich Company. On the whole, this volume is the least interesting of the three that have appeared being made up mostly of a collection of odds and ends occupying one or two pages each.

The Development of American Industries, *edited by John G Glover and William B Cornell, Prentice Hall, New York 1932 932 pages, $5* A general conspectus of American industry in 61 chapters covering as many different fields The aeronautical section, by "Casey" Jones and H. F Merrill is a good summary in 28 pages of the history of the American industry, of its status in the spring of 1931 (the reason for not bringing the records more nearly up to date is not apparent), of the way in which airplane engines are built and mounted, of the government's activities in the field, and of the growth of air transport

Meteorology, *by Donald S Piston, T Blakiston's Son & Co, Philadelphia, 167 pages* A very good general text on meteorology, written with more emphasis upon the mechanics of the atmosphere and of air motion than upon climate or forecasting Forecasting practice is covered in a single brief chapter The book presupposes no great knowledge of mathematics or physics, and contains a helpful appendix in the form of a collection of illustrative problems For the reader who wants to get a general survey of the background of the weather map it should be a useful volume, though it possesses no very extraordinary novelty nor great inspiration

The Hart Aeroplane, *British Air Ministry, London, 1933, 74 pages and 40 plates, 60 cents approximately.* Like many other British manuals that have been reviewed in Aviation from time to time, this one covers not only rigging and maintenance of the aircraft but design and construction as well It goes into a rather unusual amount of detail, even for this series of booklets, and has many plates covering such details as the internal construction and working of the oleo strut A very useful guide to certain British design tendencies as exemplified in the present standard water cooled engine day bomber of the Royal Air Force

Britain's Air Peril, *by Major C C Turner, Isaac Pitman & Sons, London and New York 1933 132 pages, $1 50* An argument for the maintenance and enlargement of Britain's air force, this follows very much the same course as similar volumes published in other countries but it is more conservative and more thoughtful in manner than the common rule Some of the author's political views will be hard for Americans to follow but his brief discussion of the nature of war and of the place that an air force takes will be of as much interest here as in England Major Turner is much alarmed over the course of disarmament discussion at Geneva, and argues that "no country has an air force sufficiently strong for all the functions it would have to perform in a first class war, but the British air force is inadequate to a dangerous degree It has less than half the strength needed for security" In a general summary of the air strength of the nations of the world the author puts France first the United States second Japan third, and Great Britain fifth or sixth

The Standard Air Post Catalog *edited by Donald E Dickason, The Berkshire Exchange, Wooster, Ohio 1933 454 pages, $2* It is hardly necessary to do more than mention the existence of this book by way of review To those interested in stamp collecting, it is an invaluable guide, a standard work in the field For those outside the charmed circle of philately it will have but little appeal though even for them it furnishes an interesting historical record of certain air mail developments in America and abroad

WHAT OUR READERS SAY

Boosting airfoil lift

By Richard M. Mock

THE ORIGINAL table of lift increasing devices prepared for Aviation for May was not intended to be a comprehensive study of the subject. Since this table was published there has been some discussion of the values used and attention has been called to one fundamental error The value used for "Speed Range Ratio" should have been based on the area of the basic airfoil with lift increasing device retracted as in high speed flight (A better term for this value is "Speed Range Factor" as the value is not the same as the actual speed range nor is it directly proportional to it.) The value should be calculated using a lift coefficient based on the contracted area as we are interested in the total lift in pounds. Contracting the area in flight would produce a higher speed range than possible for a wing with the same area and lift and drag coefficients but not contractable. It is therefore reasonable that wings capable of having their areas reduced should not be penalized in such a comparison This was also brought out by Fred E. Weick of the N.A.C.A and Harlan D. Fowler, inventor of the Fowler variable area wing

Considering this, the values used in the table published in May for the ratio "C_L max./C_D min" for three cases—the "Handley Page automatic slot," "Split flap with hinge moved back to 90 per cent of chord," and the "Fowler wing" should be increased by 1.13, 1 133, and 1.31 respectively Similarly the values for "Per Cent Improvement in Speed Range Factor" should be increased by these values

The lift coefficient, however, should be based upon the extended wing area For this value we are interested in the comparative lift of a unit of area due to change in form and not due to a change in area Therefore the lift coefficient is based upon the area used during the test for maximum lift.

Mr Fowler has also called attention to the fact that for a given wing area and landing speed the total lift is so much greater using a variable area lift increasing device such as his that the difference in structural weight compared with a fixed area wing, is negligible, and that with lift increasing devices having a high drag (low L/D at maximum lift) the possible load factors due to high accelerations are likely to be less than those encountered with a normal wing

Since the original table was published, the N A C A has released Technical Note No 459 which is used as a basis for the accompanying table In order to facilitate comparison with the values in the original table, the "Speed Range Factor" is given as based both on the extended and contracted areas The values based on the extended area differ from those given in T N 459 For example, the chord of the Fowler flap is 40 per cent of the basic wing chord and is 40 deg. to the basic wing chord. In T N 459 the lift coefficient (based on contracted area) is divided by 1 40 because of the 40 per cent flap chord In the table 1.31 was used as the area projected on the basic chord line is increased only 31 per cent. For the values in the accompanying table I used the overall area making no allowance for the gap between the slat and the main wing Thus comparison with the original table is facilitated

The Reynolds Number for all tests is 609 000 which corresponds to about one-third that for an ordinary small airplane at landing speed (T.R. 400)

		Angle of lift increasing surface to basic airfoil	Flap chord in per cent of basic airfoil chord	Max. lift coefficient C_L max.	Speed range factor C_L max./C_D min.	L/D at max lift (2)	Angle of attack of basic airfoil at max lift	Per cent improvement in lift: Over plain airfoil (3)	Per cent improvement in lift: Over simple flap	Per cent improvement in speed range factor: Over plain airfoil (5)	Per cent improvement in speed range factor: Over simple flap	Reference N.A.C.A. report
Fowler wing with N.A.C.A. 22 slat and round nose of basic airfoil	[illegible]	Slat 46° Flap 40°	Slat 16.5% Flap 40%	2.40	[illegible]	3.36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T.N. 459
N.A.C.A. 22 slat on plain wing with rounded nose	[illegible]	Slat 45°	Slat 14.5%	[illegible]	[illegible]	4.8	30°	[illegible]	None	[illegible]	None	T.N. 459

1 In comparing properties of modified sections with the plain basic section the coefficients used in each case were obtained under similar test conditions. Drag coefficients were taken with slat closed (if movable) and with flap neutral

2 A low value of L/D at maximum lift indicates a steep glide angle and consequently a short landing An L/D of 8 corresponds to a gliding angle of approximately 7 deg., and a value of 3 5 means about 16 deg. (T.R. 426)

3 Based on total wing area lift increasing device extended and projected on original chord line. Actually this area is structural area necessary and forms the basis for the comparison with the simple flap

4 With slat and flap retracted the airfoil is not perfect, having a drag coefficient of 0 0182 compared with 0 0156 for the plain airfoil.

5 Based on contracted area See text.

THE BUYERS' LOG BOOK

Testing machine control

THE Baldwin-Southwark Corporation of Philadelphia, Pa, has lately announced the availability of a new type of recorder controller which can be applied to hydraulically operated tensile testing machines It provides full automatic control as an auxiliary to manual control, and may be applied to existing machines with little change in basic arrangement Functionally, this equipment provides an autographic stress-strain recorder, which ordinarily draws a curve up to insipient failure or which by a simple adaptation, may be made to continue the curve through failure on any material At the same time the instrument automatically controls the load application to effect a constant rate of strain increment, a constant rate of load increase and if desired will maintain the load at a constant value During these operations the instrument in no way limits the manual control, the automatic or the manual may be used at the will of the operator —AVIATION, *July, 1933*

Operating and recording unit of Baldwin-Southwark automatic testing machine control.

Refueling truck

THE Columbian Steel Tank Company has recently delivered to the United States Army Air Corps, twelve airplane and airship refueling units to be used on military flying fields in the United States and its possessions

The truck chassis incorporates a six-wheel drive transmission with eight speeds forward and two speeds in reverse, driven by a Hercules 130 hp, six-cylinder engine. The refueling equipment consists of a 1,500-gal gasoline tank, a 100-gal oil tank, and a 50-gal water tank. A compartment for compressed air bottles is also provided The servicing elements are provided with pumps and meters, the former powered by a drive shaft from the truck engine.—AVIATION *July, 1933*

Composite paneling

MET-L-WOOD CORPORATION of 6755 West 65th Street, Chicago, has been developing recently a composite paneling which has had some usage as cabin lining for airplanes Panels consist of two thin sheets of aluminum separated by a balsa wood core On one side the aluminum sheet is perforated with small holes The other side is smooth and is supplied with a slightly etched surface to take paint or other finishes Panels may be applied either by screws or by rivets, and may be finished using Di-Noc or decalcomania transfers to obtain various wood grain or other patterns The weight varies with the thickness of the panel, but runs from about ⅞ oz per square foot up, or slightly higher than straight balsa wood panels of the same thickness —AVIATION, *July, 1933*

Lamp focussing device

TO ASSIST in focussing the new General Electric Bi-post lamp now specified for airway beacon service by the U S Department of Commerce, the Nela Park engineering department of General Electric Company has developed a pre-setting device This consists of a dummy lamp bulb in which the lighting element has been replaced by a small pointer with a knob on the end The latter is accurately located as to light center and axial alignment Simply by inserting the device in a socket and then placing the knob at the focal point of the optical system as determined by sighting the socket can be properly set Every lamp inserted thereafter will be in accurate focus. The device is intended for use with lamps of 4-in. light center length —AVIATION, *July, 1933*

Focusing jig for G.E. Bi-post Lamps.

Valve guide puller

AIR TRANSPORT EQUIPMENT, Inc, has developed a new type of puller for removing the steel guides from Wright Whirlwind cylinder heads The puller spindle is made of a special heat treated high chrome nickel steel, and is mounted on a large-size Timken thrust bearing It is sufficiently rugged to make possible the removal of guides that are apparently frozen fast in the heads —AVIATION *July, 1933*

Recent trade publications

• *Engineering Leadership*, Pratt & Whitney Aircraft Company, Hartford, Conn An elaborately gotten up booklet of some twenty pages containing the stories of many of the most famous users of Pratt & Whitney engines Maps and photographs have been given unusual artistic treatment.

• *Flying with the Sperry Horizon and the Directional Gyro*, Sperry Gyroscope Company, Inc, Brooklyn, N Y A twenty-page booklet giving details of the construction, installation and operation of Sperry gyroscopic instruments for aircraft Numerous photographs and diagrams are included

• *Fafnir Ball Bearings for Aircraft*, The Fafnir Bearing Company, New Britain, Conn An aeronautical supplement to the Fafnir engineering data book It describes in detail, and gives the necessary installation data for all types of ball bearings for aeronautic purposes

• *Smith's Welding and Cutting Equipment, 1933,* Smith Welding Equipment Corporation, Minneapolis, Minn. A complete catalog of tools and equipment for gas welding

• *Catalin, the Gem of Modern Industry*, American Catalin Corporation, New York A bulletin describing the uses of a synthetic resinous material, available in many forms for a variety of industries Its principal use in aircraft is for instrument board and control lever handles, knobs, etc The catalog includes a sample piece of the material

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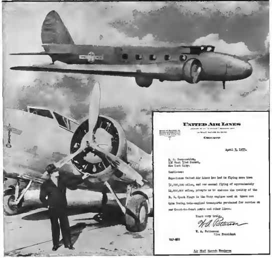

Above... One of the sixty new type, low-wing, all-metal Boeing Monoplanes powered with two 550 h.p supercharged Wasp engines. These planes carry ten passengers two pilots, a stewardess and mail and express. Fully loaded they climb 830 feet per minute to a ceiling of 18 400 feet. Coast-to-Coast in less than twenty hours.

Below... P. G. Johnson, President, United Air Lines and Boeing Airplane Company, and a "close-up" of one of the Wasp engines used in the plane shown above. Note the B. G. Shielded Spark Plugs.

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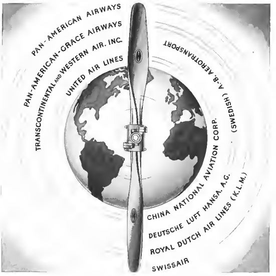

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SERVICE SECTION

EQUIPMENT ACCESSORIES SUPPLIES
for Airport Construction Operation and Maintenance

SEARCHLIGHT SECTION

(Continued on opposite page)

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WANTED—Reliable representative in each section of the country to assist large airline operator in the sale of surplus aircraft, engines and equipment. To an experienced man we believe that we can offer a unique and profitable proposition. P-216, Aviation 520 No Michigan Ave., Chicago Ill

WANTED—Several good draftsmen and engineers. Experienced on steel and dural construction. P-222, Aviation, 330 West 42d St New York City

WANTED—Aircraft Factory Superintendent with experience on steel fuselages. P-223 Aviation 330 West 42d St New York City

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WANTED Scintilla or German Bosch Mag for OX-5. Must be good and reasonable in price. W A Field Stratford Conn

WANTED—Licensed 2 or 3 place air-cooled open ship. All cash. Prefer Great Lakes Franklin Arrow, Gypsy Moth or similar ship. Give full particulars and price delivered Pittsburgh Pa. O H Babcock Jr Box 36 Scottdale, Pa

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AIRPLANES FOR SALE Licensing Stinson Jr in fine condition. Must sell. Will consider trade smaller ship or car. FS 220 Aviation 520 No Michigan Ave. Chicago Ill

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FOR SALE OR TRADE Challenger Robin like new NC licensed complete $1 200 Warner (Lincoln PT licensed) $875. Lyc Stinson Jr like new $1,975. Waco A Continental 210 like new $3 500. Ten other makes types. Omaha Aircraft Exchange So Omaha, Nebr

EAGLEROCK powered with new late type Kinner front exhaust motor. Plenty of extras $1 125.00. Becker Flying Service Inc 240 Franklin St Buffalo N Y

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FOR SALE

(Continued from opposite page)

FOR SALE Alexander Eaglerock Model A-2 dual ignition OX-5 engine ship is airworthy but needs to be re-covered to secure license. As is unlicensed this ship is a mighty good value ready for fly-away delivery, priced at $250.00. NB-4 Series 2 total time on ship 50 hours. Can't be told from new, less engine but suitable for Warner Jr 90 hp or 90 hp Lambert, beautiful finish black and silver, equipped with low pressure tires, brakes, adjustable stabilizer, price $800.00 fully equipped with Warner Jr 90 hp engine, only 50 hours time on engine, price $750.00. NB-8 Trainer folding high wing monoplane less engine and propeller, completely covered, only 6 hours total time, not eligible for license, suitable for any air-cooled engine from 40 hp to 60 hp, price $140.00. NB-1 Racer long wing monoplane, clipped wings, less motor, will accommodate any radial engine from 60 to 90 hp, all metal wings, beautiful cross-country job, price $300.00. NB-8 Trainer latest 1932 model with new 80-90 hp Genet engine, equipped with a completely enclosed Trainer hood for winter flying, ship and motor total time demonstrating only, 28 hours. Special red, white and blue hand rubbed finished, show job specially priced at $1 100.00. Used OX-5 engines complete crated $30.00. Warner Jr 90 hp, less than 80 hours, completely crated $300.00. Velie M-5 65 hp completely rebuilt, block tested, in perfect condition, ready for flight, price $185.00. Overhauled rebuilt block tested Hispano Suiza all models $75.00. 80 hp Genet completely rebuilt block tested perfect condition crated, ready for flight $200.00. Nicholas-Beazley Airplane Co Inc English at North St, Marshall, Missouri

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LINCOLN PT AIRPLANE Kinner powered good condition, licensed, standard equipment and color $875. Irvin Exhibition Parachute Outfit (includes 28 ft seat pack and 24 ft breast pack and equipment $190. Complete set 104 Cadet System Wall Charts and fixtures, $35) Airways Equipment Company Box 930 Birmingham Ala

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INDEX TO ADVERTISERS

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